ORDINANCE NO. 5789

AN ORDINANCE TO REPEAL CHAPTER 171 **STREETS AND SIDEWALKS** AND ENACT A REPLACEMENT CHAPTER 171, **STREET AND SIDEWALKS** OF THE UNIFIED DEVELOPMENT CODE

WHEREAS, it is proper and appropriate for the City Council to enact a **Purpose** section to Chapter 171, **Streets and Sidewalks** and to better define and clarify "retaining wall"; and

WHEREAS, the Minimum Street Standards manual needed to be updated from its 1996 version and be adopted as a technical supplement of the **Street and Sidewalks** Chapter; and

WHEREAS, certain technical criteria for street and sidewalk construction should be moved from this chapter and placed with the newly adopted Minimum Street Standards manual.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF FAYETTEVILLE, ARKANSAS:

Section 1. That the City Council of the City of Fayetteville, Arkansas hereby repeals the existing Chapter 171, **Streets and Sidewalks** and enacts a replacement Chapter 171, **Streets and Sidewalks** along with the replacement Minimum Street Standards manual of the Unified Development Code as attached as Exhibit A.

PASSED and **APPROVED** this 4th day of August, 2015.

APPROVED:

By: _____
LIONELD JORDAN, Mayor

ATTEST:

By: Sondra E. Smith
SONDRA E. SMITH, City Clerk Treasurer

CITY CLERK / TREASURER CITY OF FAYETTEVILLE ARKANSAS WASHINGTON COUNTY

EXHIBIT
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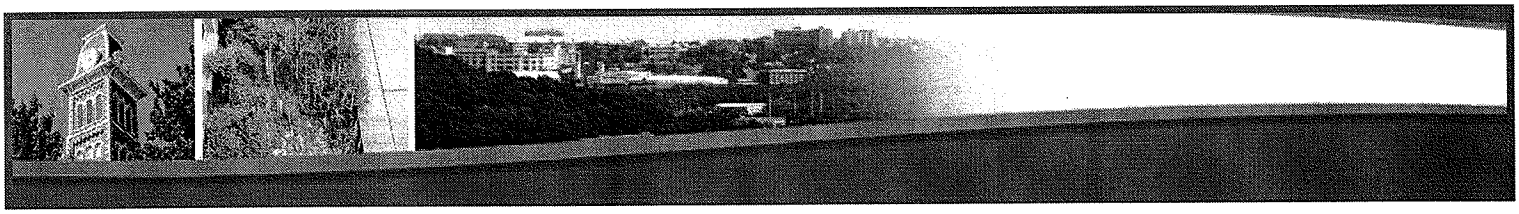
CITY OF
Fayetteville
ARKANSAS

Minimum Street Standards

August 2015



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CHAPTER 1 – GENERAL PROVISIONS

1.1 AUTHORITY OF THIS DOCUMENT

This document adopted as Exhibit A of Ordinance 5789 of the City of Fayetteville, provides technical procedures and design standards to support Chapter 171: Streets and Sidewalks and other applicable Chapters of the Title XV Unified Development Code (UDC).

1.2 INTENT AND PROVISIONS

These Standards shall be required for all development projects within the jurisdiction of the City of Fayetteville. The City's review and approval of any plans, reports, or drawings or the City's inspection and approval of any improvements constructed by the Developer in accordance with these Standards, does not constitute a representation, warranty, or guarantee by the City that such improvements are free from defects or will operate adequately for the purpose intended. These Standards shall also be used as a guidance document for projects to be constructed by the City, including construction by City crews.

The chapters and appendices that make up these standards pertain to planning, design, approval, construction, inspection, testing, and documentation of street improvements. The intent of this manual is to establish the minimum acceptable standards.

These Standards are a supplement to the City of Fayetteville Code of Ordinances Title XV Unified Development Code and other Ordinances. Where conflict between these Standards and City Code exists, the Code shall govern.

1.2.1 Objectives of Street Standards

A. Minimum Standards

These Standards shall be the minimum standards necessary for design and construction of all street improvements required for development projects within the jurisdiction of the City of Fayetteville. Special situations as determined by the City may require different facilities and/or standards. For items not covered by these Standards, the City may require the use of resource standards in Section 1.3 below.

B. Objectives

It is the objective of these Minimum Street Standards to address the following:

1. Public Safety and Convenience. To protect the public health, safety, and welfare and to minimize public inconvenience resulting from construction and maintenance activities within the public rights-of-way.
2. Maintaining Public Use. To assure that bicycle, pedestrian and vehicular uses of rights-of-way are the primary uses thereof and that the rights-of-way are properly maintained during construction and repair work in these areas.
3. Standardizing Criteria. To protect the City's infrastructure investment by establishing standardized design, materials, construction, and repair criteria for all public improvements.
4. Optimizing Use. To optimize the use of the limited physical capacity of public rights-of-way held by the City.
5. Protecting Private Property. To protect private property from damages that could occur because of faulty design and construction of public improvements upon public rights-of-way and easements.
6. Inspection. To provide criteria for inspection of public and private improvements, by the City or Design Engineer's designated inspector, in order to assure conformance with approved plan's uniformity, proper construction techniques, and to ensure that acceptable materials are used for the construction process of such public and/or private improvements.

1.3 RESOURCE STANDARDS

The following Resource Standards (the latest editions unless otherwise stated) may be used as reference material when certain design or construction methods and materials are not specifically addressed in these Standards and require approval of the City Engineer.

A. List of Resource Standards for Reference

1. Arkansas State Highway and Transportation Department, Standard Specifications for Highway Construction (Latest Edition unless otherwise specified).
2. American Association of State Highway and Transportation Officials, A Policy on Geometric Design of Highways and Streets.
3. Institute of Traffic Engineers (ITE), Trip Generation Volumes 1 through 3.
4. Institute of Traffic Engineers (ITE), Designing Walkable Urban Thoroughfares: A Context Sensitive Approach
5. Institute of Traffic Engineers, Highway Capacity Manual.
6. ASTM, American Society for Testing and Materials.
7. Federal Americans with Disabilities Act, (A.D.A.) Regulations.
8. U.S. Department of Transportation, Manual on Uniform Traffic Control Devices (M.U.T.C.D.)

9. Federal Highway Administration, Roundabouts: An Informational Guide.
10. American Association of State Highway and Transportation Officials, Guide for the Development of Bicycle Facilities.
11. Standard Specifications for Transportations Materials and Methods of Sampling and Testing and AASHTO Provisional Standards.
12. City of Fayetteville standard drawings, details and specifications when available.
13. National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide

1.4 AUTHORITY OF THE CITY ENGINEER

The City Engineer shall have the authority on behalf of the City to determine that all design and construction is completed to a level that is equal to or exceeds the requirements set forth in these Minimum Street Standards.

1.5 ENFORCEMENT RESPONSIBILITY

It shall be the duty of the City Engineer acting on behalf of the City of Fayetteville to enforce the provisions of these Minimum Street Standards.

1.6 AMENDMENTS AND REVISIONS TO STANDARDS

These Standards may be periodically amended as necessary to provide additional clarity or to reflect changes in policy or in construction or engineering practice.

Technical revisions shall consist of such additions, revisions, and corrections to these Standards as may, in the judgment of the City Engineer, be necessary to better conform to good engineering and/or construction standards and practice. The City Engineer shall approve only those proposed technical revisions that are consistent with all existing policies relevant to the revision and are consistent with existing law. Technical revisions shall become effective when approved, in writing, by the City Engineer.

1.7 DEFINITIONS OF TERMS AND ABBREVIATIONS

When the following words, phrases, or abbreviations appear in these Standards, they shall have the following definition and meaning. Where conflict between these Standards and Chapter 151:Definitions in the Unified Development Code exists, the Code shall govern.

AASHTO – American Association of State Highway and Transportation Officials.
ABC – Aggregate Base Course.
Access Management – The concept of a public agency controlling the location of access points in order to achieve the dual purposes of providing access to individual land uses and limiting access on higher order streets in order to facilitate the smooth flow of traffic with a limited amount of impedance.
ACI – American Concrete Institute.
ADH – Arkansas Department of Health
AHTD – Arkansas State Highway and Transportation Department
AISC – American Institute of Steel Construction.
Alley – A minor public way dedicated to public use for utility easements and vehicle access to the back or the side of properties abutting a street.
ANSI – American National Standards Institute.
Applicant – The person or designated agent providing pertinent information for preparation of permit, etc. This is often the Developer.
Approach Taper – A taper from the point where all approaching traffic must shift laterally, to the point of the beginning bay taper.
APWA – American Public Works Association.
Arterials – A street or road of considerable continuity which serves or is intended to serve as the principal traffic way between separated areas or districts which is the main means of access to the primary street system or expressways.
ASA – American Standards Association.
ASTM – American Society for Testing and Materials.
ATSSA – American Traffic Safety Services Association.
Attached Sidewalk – Sidewalk that is adjoining the curb.
Bay Taper – A taper from the edge of the adjacent through traffic lane to the beginning of the full width of the turn lane storage.
Bicycle Facilities – A general term denoting improvements and provisions made by public agencies to accommodate or encourage bicycling, including parking facilities, mapping of all bikeways, and shared roadways not specifically designated for bicycle use.
Bicycle Lane (Bike Lane) – The portion of the shoulder or roadway that has been designated by striping, signing, and pavement markings for the preferential or exclusive use of bicyclists.
Bridge – Any structure conveying a roadway or path over a body of water or other feature. Bridges shall be designed to carry a varying combination of loading, including vehicular, bicycle, and/or pedestrian traffic.
Calendar Day – Each and every day shown on the calendar, beginning and ending at midnight.
Chicanes – Offset curb extensions which change the path of vehicular travel from straight to curvilinear.

City – The City of Fayetteville, Arkansas
CMP – Corrugated Metal Pipe.
Code – The latest official adopted ordinances, policies, codes, and/or regulations of the City of Fayetteville.
Collector – A street which in addition to serving abutting properties, intercepts minor streets, connects with community facilities and carries neighborhood traffic to the major arterial street system.
Construction Costs – Generally, the cost of all right-of-way, earthwork, paving, drainage, structures, signing and striping, traffic control, curb and gutter, sidewalk, and utility work necessary to complete the required improvements.
Consultant Engineer – An Arkansas licensed professional engineer working on behalf of the Developer.
Continuity – The continuous length of a roadway segment that is uninterrupted by 90 degree turns or controlled intersections.
Contract Documents – The executed contract agreement, approved plans, and technical specifications, prepared by an Arkansas licensed professional engineer, for constructing a facility.
Contractor – The person, firm, or organization to whom a construction contract is awarded by the Developer or City. Agents, employees, workers, or designers employed by the Contractor are also bound by the terms of the contract or permit.
Corner Sight Distance – The distance necessary for the driver of a motor vehicle stopped at a stop sign on a Minor Street or driveway to see approaching vehicles, pedestrians, and bicyclists along the intersecting major street and have sufficient space to make any allowed move to cross the Major Street or merge with traffic on the Major Street without causing vehicles, pedestrians, or bicyclists traveling at or near the design speed on the major street to slow down. The controlling distance for design is the longest distance, generally the distance necessary to merge with traffic.
Cross Slope – Slope of the pavement surface, excluding gutter, measured perpendicular to the street centerline.
Days – Intended as calendar days and not working days unless stipulated as working days.
Deceleration Lane – A right-turn lane or left turn lane lengthened to provide for safe reduction of travel speed.
Departure Taper – A left-turn bay from the point where through traffic beyond the intersection begins a lateral shift to the left to the point where the through lane is adjacent and parallel to the centerline.
Design Speed – The speed determined for design which takes into account the physical features of a street influencing vehicle operation; the maximum safe speed maintainable on a specified section of street when conditions permit design features to govern. Design speed is normally 5 to 10 mph higher than the posted speed limit to provide a factor of safety and allow for other conditions or uses of the street that may affect vehicle operation.

Designer – The person or company responsible for the creation and submission of contract documents or construction plans for the purpose of one-time construction of a facility. This person shall be an Arkansas licensed professional engineer.
Developer – Any person(s), parties, partnerships, or corporations, private or public, engaging in activities described as development.
Development – Shall include, but shall not be limited to, the construction of a new improvement, the construction of an addition to an existing improvement, or a parceling which results in the need for access and utilities.
Driveway – A private access from a public or private roadway.
Driveway Approach – The portion of the driveway lying in the public right-of-way or public access easement between the street gutter lip or roadway of a public street and the right-of-way or public access easement line, for the full width of the access, including both apron and side slopes.
Engineer of Record - The person or company responsible for the creation and submission of contract documents or construction plans for the purpose of one-time construction of a facility. This person shall be an Arkansas licensed professional engineer.
FEMA – Federal Emergency Management Agency.
Fence – An artificially constructed barrier of wood, masonry, stone, wire, metal, or other manufactured material, or combination of materials, erected to enclose, partition, beautify, mark, or screen areas of real property.
FHWA – Federal Highway Administration, Department of Transportation.
Final Acceptance – The written notification from the City, after the City Engineer finds the Warranty Period to be satisfactorily completed, that all public improvements are free of defects and the City releases the Developer from future maintenance obligations.
FIRM – Flood Insurance Rate Map.
Franchise Agreement – An agreement between the City and certain private utility companies, specifying terms and conditions for use of the City's public rights-of-way or other public lands.
Frontage – The property line or lines of a lot which coincide with a right-of-way or other public open space.
Greenspace – Area of right-of-way between the face of the curb and the sidewalk.
HMA – Hot Mix Asphalt
HHOD – Hillside Hilltop Overlay District
Improvements – All public or private improvements within City rights-of-way or easements.
Initial Acceptance – This is the City's document and process, by which the City initially accepts for ownership, maintenance, and warranty the public improvements identified in the approved plans for a specific project.
Inspector – An authorized representative of the Design Engineer, assigned to make inspections to assure work is completed in compliance with plans, standards and specifications.

Intersection Nose – The radius or distance from the end of the storage bay to the near edge of the cross-route exit lane for the left-turning vehicle. For left-turn bays the cross-route exit reference is normally the centerline of an unchannelized 2-way street or the far edge of the median in a channelized street.
Intersection Sight Distance – Refer to Corner Sight Distance.
"Issued for Construction" Plans – Design plans that conform to these Standards and are signed and stamped by the Designer, ready for distribution to the Contractor for construction.
ITE – Institute of Transportation Engineers.
Landscaping – The area within the boundaries of a given lot which consists of planting materials, including but not limited to trees, shrubs, ground covers, grass, flowers, decorative rock, bark, mulch, and other similar materials.
Knuckle – A bulb or semi-circular extension of a curb on the outside edge of a street or at an "L" turn to provide more street frontage for adjacent lots.
Lane Width – The width of a travel lane measured from the centerline of the lane striping to the centerline of the parallel lane stripe, the face of curb, or to the lip of gutter, whichever is applicable.
Lift – The maximum specified thickness of material that may be placed at one time.
Lip – Defines the outermost edge of the gutter pan.
Local Streets – All street facilities that are not in one of the higher systems. Their primary purpose is to provide direct access to abutting lands and connections to the higher classification streets.
Mini-Roundabout – Elevated circular islands placed in the center of a street intersection to reduce vehicular travel speeds by requiring the motorist to travel in a counter clockwise direction around the circular island.
MSP - Master Street Plan
MUTCD – Manual on Uniform Traffic Control Devices.
Neckdowns – A narrowing of the roadway for traffic calming at intersections or mid-block.
Neighborhood – A residential or commercial area defined by ordinance, resolution or common understanding.
Opinion of Cost (Cost Estimate) – Unit costs, based on those approved by the City and assigned to materials and related quantities.
Ordinance – A law established by the City Council.
OSHA – Occupational Safety and Health Administration.
P.C. – Point of curvature.
P.C.R. – Point of curb return.
Pedestrian Walkway – A public facility for pedestrian traffic either within the right-of-way of the vehicular traffic roadway or within a public easement (e.g., public tunnels).
Permittee – The holder of a valid permit issued in accordance with these Standards or other City related process.

Phasing Plan – A plan that defines improvements to be completed in specified parts over a defined sequence.
P.I. – Point of intersection.
Plans – Construction plans signed by the City depicting public improvements to be constructed for the project.
Pre-Construction Meeting – A meeting between the Designer and assigned agents and the City to review proposed work necessary to construct the project, **prior** to proceeding with the work. A meeting may be required for each project, at the City's discretion.
Professional Engineer (P.E.) – An Arkansas licensed professional engineer.
Professional Land Surveyor (P.L.S.) – An Arkansas licensed land surveyor.
Project – The public or private improvement(s) designated in the approved plans, which are to be constructed in conformance with these Standards. The term "Project" includes any and all public or private improvement projects whether development projects, private utility projects, or capital improvement projects.
Project Supervisor – The person appointed by the Developer or Contractor for management and control of the work on the project as performed by the Contractor and Subcontractors.
Proposed Roadway Improvements – Those roadway improvements deemed necessary due to the impact of the project development.
P.T. – Point of tangency.
Public Improvements – Those public-type facilities to include: pavement, curb and gutter, sidewalk, pedestrian/bike paths, storm drain facilities with related appurtenances, culverts, channels, bridges, water distribution or transmission facilities with related appurtenances, sanitary sewer collection facilities with related appurtenances, water and waste water treatment facilities, pavement markings, signage and striping, traffic signals and related appurtenances, erosion control and right-of-way grading, or earth excavation processes integral to construction of other public improvements listed herein.
Punch list, Initial or Final – A written list of work items, compiled by the Inspector, which do not conform to these Standards, the plans or other associated City Codes that govern the project.
Raised Crosswalk – A roadway crossing that slightly elevates the pedestrian crossing surface above the general roadway surface. A raised crosswalk is a traffic calming device.
Record Drawings – (Also As-Built Plans) Original design drawings updated by a Professional Engineer depicting all modifications from the design that occurred during construction.
Report – A bound document, the contents of which may contain certain necessary analyses, surveys, tests, exhibits, and other pertinent data supporting the subject matter.
Right-of-way – (Also ROW or "public right-of-way.") The land opened, reserved or dedicated for streets, sidewalks, drainage or other public purposes.
Roadway – The portion of the highway, arterial, collector, or local street, including shoulders, intended for vehicle and/or bicycle use.

Roundabout – A circular street intersection used as a traffic control device in lieu of a multi-way stop or a traffic signal.
Shall – A mandatory condition.
Shared Roadway – Any roadway upon which a bicycle lane is not designated and which may be legally used by bicyclists regardless of whether such facility is specifically designated as a bikeway.
Should – An advisory condition, recommended, but not required.
Sidewalks – Paved or otherwise improved area for pedestrian use.
Specifications – Construction specifications and standards adopted by the City.
Speed Tables - Elevated areas placed in the street roadway with the intent to slow vehicular traffic. The geometrics of the speed table determine how fast it can be navigated.
Stop Work Order (S.W.O.) – A written instruction/notice from the City, revoking the Developer's and/or Contractor's rights to continue work on the project due to nonconformance with these Standards.
Stopping Sight Distance – The distance required by the driver of a vehicle traveling at the design speed to bring the vehicle to a stop after an object on the road becomes visible. This distance is measured from the driver's eye, 3.5 feet above the pavement to the top of an object 2 feet high on the pavement anywhere on the roadway.
Storage Length – The distance from the end of the bay taper to the nearest flow line extension of the intersecting street.
Street – A strip of land intended primarily as a means of vehicular and pedestrian travel which may also be used to provide space for sewers, public utilities, trees and sidewalks.
Streetscape – Pedestrian and landscape improvements in the right-of-way, generally occurring between the curb and the right-of-way line. Streetscape generally includes sidewalks, street trees, pedestrian lighting, fencing, furnishings, and landscaped areas, including medians and irrigation.
Structure – Anything constructed or erected with a fixed location below, upon, or above grade, including without limitation foundations, traffic signals, fences, retaining walls, buildings, inlets, vaults, poles, bridges, and major drainage facilities.
Subcontractor – A person, other than the Contractor, supplying labor and materials, or labor only, for the Project, and working for the Contractor or the City.
Substantial Completion – Major completion of all Work for the Project, prior to certain inspection(s) or the creation of Punch lists.
Target Speed – The desired operating speed of a roadway.
TIS - Transportation Impact Study.
Trail – Any path used by pedestrians or bicyclists within a public right-of-way or easement. This would include concrete, gravel, or natural surfaces.
U.D.C. –Unified Development Code
USGS – United States Geological Survey.

Variance – A grant of relief to a person from the requirements of these Standards. A variance, therefore, permits construction in a manner otherwise prohibited by these Standards.

Warranty Period – The period of time that the Developer or Contractor is responsible for material and workmanship defects in the public improvements, until written notification by the City of final acceptance of the public improvements.

Work – All construction activity, including materials, labor, supervision, and use of tools and equipment necessary to complete the Project in full compliance with these Standards, or approved Plans.

1.8 INTERPRETATION OF STANDARDS

In the interpretation and application of the provisions of these Minimum Street Standards, the following principles apply:

1.8.1 Governing Standards

These Standards are a supplement to the City of Fayetteville Code of Ordinances Title XV Unified Development Code and other Ordinances. Where conflict between these Standards and City Code exists, the Code shall govern.

1.8.2 Prior Acceptance of Construction Plans

These Minimum Street Standards shall not modify or alter any street construction plans that have been filed with and accepted by the City prior to the effective date of the ordinance or resolution adopting these Standards. This exception shall be subject to the conditions and limitations under which said plans were accepted by the City Engineer.

1.9 VARIANCES AND APPEALS

1.9.1 Variances

Any design that does not conform to these Standards must be approved by the City Engineer. Variances from these Standards will be considered administratively on a case-by-case basis following a written request for a variance prepared by a Professional Engineer and submitted to the City Engineer. If the developer, contractor, or utility responsible to the City for public improvements desires to design and construct such improvements in variance to criteria in these standards, such variance(s) shall be identified in a written attachment to the initial submittal of construction plans to the City Engineer. The design submitted for review shall show the variance.

To assist with their plan preparation, designers may submit variance requests, along with sufficient documentation to support the variance, prior to formal submittal of construction plans for informal advisory consideration. Such advisory consideration shall not be binding on the City Engineer, but may help to guide the requestor in the preparation of plans.

The variance request(s) shall include the following:

a. Identifying Issue. Identification of the standard to be waived or varied and why the standard is unfeasible or is not in the public interest.
b. Proposed Alternate Design. Identification of the proposed alternative design or construction criteria.
c. Comparing to Standards. A thorough description of the variance request including impact on capital and maintenance requirements, costs, and how the new design compares to the standard.
d. Justification. The Professional Engineer must determine and state that the variance will not be detrimental to the public health, safety and welfare, will not reduce design life of the improvement nor cause the City additional maintenance costs. The proposed plan (as varied) must advance the public purpose of the standard sought to be varied equally well or better than would compliance with such standard.
e. Approval or Denial of Variance. Based upon review of the plans and additional information submitted, and an analysis of the criteria set forth in this subsection the City Engineer may approve or deny the variance request.
   If the City Engineer approves the variance request, the plans will continue to be reviewed and approved within the typical review process.
   If the City Engineer denies the variance request, the developer shall subsequently submit revised plans in compliance with these Standards. The City Engineer shall provide a written response outlining the basis for all approvals or denials of variance requests.

1.9.2 Appeals

If a variance request is denied by the City Engineer, the Developer may appeal the decision as outlined in Chapter 155, Appeals of the Unified Development Code.

1.10 WORK SCHEDULE

Normal working day hours are 7:00 a.m. to 5:00 p.m., Monday through Friday excluding City Holidays. No work requiring Public Works Inspector observation may be conducted outside of these normal working hours without prior approval.

Contractors shall follow the guidelines of Chapter 96, Noise Control, of the City of Fayetteville Code of Ordinances. Noise from construction activities shall be limited to no later than 11:00 p.m. every day and no earlier than 7:00 a.m. on all days except Sundays when the time is extended to 9:00 a.m.

1.11 UTILITY COORDINATION

The Developer shall coordinate construction with affected private utility companies and notify said utilities in accordance with their notification prior to interruption of service or operation. Prior to construction, the Developer shall be responsible to make special arrangements with private utilities for any relocation necessary within the approved project and to coordinate such relocation activities with adjacent affected property owners. The Developer shall be responsible to notify said utilities of any damage to utility systems caused during construction.

All private utility installation within the City of Fayetteville Right of Way shall follow all requirements of Section 171.06, Occupation of Streets and Highways by Public Utilities of the City of Fayetteville Unified Development Code and the AHTD Utility Accommodation Policy.

CHAPTER 2 – SUBMITTAL AND REVIEW PROCEDURES

2.1 GENERAL

2.1.1 General Submittal Criteria and Procedures

This chapter gives criteria and procedures for submitting engineering drawings as required by these Minimum Street Standards. All other requirements for planning and related submittals can be found in the City of Fayetteville Unified Development Code.

2.1.2 Authorization/Certification

A. Designer's Signature

All documents, including plans and other submittals noted below, shall be prepared, stamped, signed, and dated by a Professional Engineer registered in the State of Arkansas.

B. Additional Requirements

The Designer should be aware that whenever unusual or serious problems are anticipated or encountered for a proposed construction project, additional information and analysis beyond the minimum requirements of these specifications and criteria will be required.

C. Final Authorization

No plans are considered final and ready for construction until signed and stamped by the Designer and signed by the City Engineer or designee. Refer to **Chapter 3, Construction Plan Submittal Requirements**.

D. Construction Traffic Control Plans

Plans for traffic control during construction for the development project must be accepted by the City prior to any issuance of grading permits for Collector and Arterial streets and on lower classification streets when deemed necessary by the City Engineer.

E. Storm Water Pollution Prevention Plans (SWPPP)

A Storm Water Pollution Prevention plan for the construction of the development project must be accepted by the City and the Arkansas Department of Environmental Quality (ADEQ), when required, prior to issuance of the grading permit.

2.2 SUBMITTALS AND CONTENT

2.2.1 Public Improvement Construction Plans

Refer to **Chapter 3**, **Construction Plan Submittal Requirements**, for further description and requirements.

2.2.2 Soils Investigation Report

Refer to **Chapter 6, Pavement Design and Report,** for the content and requirements for the soils report.

2.2.3 Pavement Design Report

Refer to **Chapter 6, Pavement Design and Report,** for the content and requirements for the pavement design report.

2.2.4 Work Area Traffic Control Plan

The plans shall be designed in accordance with MUTCD, Section VI.

2.2.5 Street Cross Sections

Typical and unique street cross sections shall be submitted for each street, including the proposed width, treatment of curbs and gutters, sidewalk systems, and bikeway systems where deviations are proposed from these Standards.

2.2.6 Drainage Report

The Developer is required to submit a drainage report in compliance with the City of Fayetteville Drainage Criteria Manual.

2.2.7 Opinion of Costs

As a separate attachment to the Plans, an Opinion of Costs for all Public Improvements will be required. The items shall be identified by unit price and total cost for each item for each type of Project.

2.2.9 Record Drawings

Record Drawings shall follow the requirements set forth in **Chapter 12, Acceptance Procedures and Record Drawings/Warranty,** and be signed, stamped, and dated by the Professional Engineer. The Record Drawings shall be prepared utilizing the original plans. They must show any deviations from the approved plans. Record Drawings must be signed and stamped with the Professional Engineer's statement that the changes have not changed the intent of the approved plans.

2.3 SUBMITTAL PROCEDURES

2.3.1 Submittal Process

The submittal shall be complete with all necessary information included for review of the project. The material shall include, but shall not be limited to the Plans, Traffic Impact Study (where required), soils report, pavement design, utility plans, erosion control plans, SWPPP, tree preservation plans where required, and the Drainage Report.

The review and approval process for Construction Plans shall comply with the following criteria:

A The Plans shall be submitted digitally in PDF format.

B All Construction Plans shall be submitted directly to the City's Engineering Division.

C Upon completion of the Engineering Division review, the Design Engineer will be notified that comments are available. These comments can be given to the Design Engineer by e-mail, ftp, cd, or portable data storage device.

D After the Design Engineer has addressed all review comments, the Consultant Engineer shall re-submit in pdf format as stated above and include a typed written response to each of the City's comments or questions either on the plans or in a separate correspondence.

E The submittal process may be repeated until such time as the City deems the plans to meet the City standards. At that time, the Design Engineer will be contacted by the City with a request to submit the final plans both in digital pdf format and four (4) hard copies as described in Chapter 3 of these standards.

F Upon subsequent review and approval by the City the plans will be stamped and signed by the City's review engineer. The Design Engineer (or Developer) will be contacted to pick up the approved plans.

2.3.2 Construction Permits

A. A Grading and Drainage Permit must be issued before construction can begin. In order to obtain a Grading and Drainage Permit, the following is required:

1. Approved Construction Plans and Drainage Report.
2. Material submittals must be submitted with the City standard checklist through the Engineer of Record and approved prior to the preconstruction conferenct.

3. The Design Engineer shall schedule a pre-construction conference with the City's Review Engineer, the City's Public Works Inspector, and the contractor.
4. The Storm Water Pollution Prevention Plan and NOI, if required, shall be submitted in PDF form to the City.
5. The erosion control measures and tree preservation fencing shall be installed.
6. An Erosion Control performance bond shall be submitted for projects over 5 acres.
7. A Public Infrastructure performance bond shall be submitted when required.
8. Signed easements or written permission from owner for off-site work.

B. Additional permits may be required by State and/or Federal agencies. All permits required shall be obtained prior to construction. These permits may include, but are not limited to AHD, ADEQ, US Army COE, and AHTD.

CHAPTER 3 – CONSTRUCTION PLANS SUBMITTAL REQUIREMENTS

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CHAPTER 3 – CONSTRUCTION PLAN SUBMITTAL REQUIREMENTS

3.1 GENERAL

3.1.1 Plan Set

The submittal shall be complete with all necessary information included for review of the project. The material shall include, but shall not be limited to the Plans, Traffic Impact Study (where required), soils report, pavement design, utility plans, erosion control plans, SWPPP, tree preservation plans where required, and the Drainage Report.

3.1.2 Horizontal and Vertical Datum

The horizontal datum shall be NAD83, Arkansas State Plane, North Zone. The units shall be U.S. Survey Foot.

The vertical datum shall be North American Vertical Datum of 1988 (NAVD88).

At least two horizontal control monuments shall be shown on each sheet. At least one benchmark shall be shown on each sheet. A horizontal and vertical tie to at least one City of Fayetteville GPS monument shall be made and the results provided to the City Surveyor.

3.1.3 Expiration of Plan Set

Public improvement construction plans shall be valid for a period of one year from the date of approval by the City Engineer unless construction has begun and continual progress is made towards completion of the improvements. Refer to section 166.20 of the Unified Development Code for time limits and the process for time extensions.

3.2 GENERAL FORMATTING AND REQUIRED INFORMATION

The following information is provided for the Developer when determining Plan format and design requirements required by the City. This information should be considered the minimum information to be provided.

3.2.1 Size of Plan Sheets

All sheets in the construction plan set shall be either 22 inches x 34 inches or 11 inches x 17 inches..

3.2.2 Title Block

A title block is required on every sheet submitted for review and acceptance. The title block shall be located in the extreme lower right hand corner, the right side margin, or along the bottom edge of the sheet. Provide an area 2" x 4" on each sheet for the City to place a stamp of approval.

A. Required Information

The following information shall appear in title block on each sheet:

1. The subdivision or Development name and project number (if applicable).
2. The type of improvement (Grading, Site Plan, Utility Plan).
3. Designer's Name, address, including zip code, telephone number, e-mail address, professional seal, company name and date.
4. Sheet number (consecutive, beginning with the cover sheet).
5. Revision block.

3.2.3 Incomplete Plans

Incomplete plan submittals or plans that do not have a sufficient level of detail will not be reviewed. The Applicant shall be notified if the submitted plans are incomplete. Partial plans may be submitted when appropriate. This may be allowed on a case by case basis and must be authorized by the review engineer prior to submittal.

3.2.4 Stamped Plans & Designer Statement

All sheets shall include the Designer's signature, stamp and date and shall be stamped and signed in accordance with the rules and regulations established by the Arkansas State Board of Licensure for Professional Engineers and Professional Surveyors.

3.2.5 Scale

A. General

All scales listed below shall be based on a standard 22"x34" full scale drawing.

All Plan and profile sheets:

1. Horizontal. 1 inch = 10, 20, 30, 40, or 50 feet.
2. Vertical. 1 inch = 5 or 10 feet.
3. Overall Plan. 1 inch = 100 feet.
4. Cross Sections. Vertical exaggeration ratio shall be a maximum of 5:1. 1:1 is preferred.

B. Bar Scale and Other Options

Show bar scale. Other scales may be used upon City approval.

C. Signing and Striping

All signing and striping plans require a scale of 1 inch = 30 feet minimum.

D. Key Map

1 inch = 500 - 1,000 feet

E. Vicinity Map

1 inch = 1,000- 1,500 feet

3.2.6 Dates

All sheets shall have dates shown in the Title Block for both Plan preparations and subsequent revisions. An electronic date shall appear on all electronic files to be submitted. Final approved construction plans shall start the date sequence again.

3.2.7 North Arrow

All design sheets shall have a north arrow oriented toward the top or right side of applicable sheets.

3.2.8 Existing Facilities

Each sheet shall show all existing facilities in a ghosted or alternate line weight or type.

3.2.9 Legend of Symbols

Each plan sheet shall include a legend that identifies the symbols pertaining to the sheet unless an overall legend is provided for the entire plan set.

3.2.10 Key Map

For plan sets that include 3 or more plan and profile sheets, each Plan and profile sheet shall provide a key map showing the location of the street being detailed.

3.3 SHEET TITLE NAMES AND SPECIFIC REQUIREMENTS

This section outlines the minimum required information to be included on specific sheets of the Plan set. The following sheets are listed in the order they should appear in the Plan set. Some sections of the Plan set may have more than one sheet, but should be labeled alike.

3.3.1 Cover Sheet

All sets of construction drawings shall include a cover sheet with the following information provided:

A. General Construction Notes

General Notes may be shown on this sheet or as a separate sheet.

B. Vicinity Map

1. Information to Include. The vicinity map shall show the location and name of all Arterial roadways within one mile of the proposed construction, and all other roadways within 1/2 mile of the proposed construction. The project area shall be indicated by shading.
2. Size. Minimum size of vicinity map shall be 10 inches x 10 inches and to a scale of 1 inch = 1,000 – 1,500 feet.

C. Engineer/Owner Contacts

The name, address, e-mail address and phone number of the Developer (owner) and Design Engineer shall be listed on the cover sheet.

D. Index

Each cover sheet shall include an index of all sheets within the Plan set.

E. Indemnification Statement

The indemnification statement shall be shown on the cover sheet. Annotate the following on Cover Sheet only:
These plans have been reviewed by the City for concept only. The review does not imply responsibility by the reviewing department, the City Engineer, or the City for accuracy and correctness of the calculations. Furthermore, the review does not imply that quantities of items on the plans are the final quantities required. The review shall not be construed for any reason as acceptance of financial responsibility by the City for additional quantities of items shown that may be required during the construction phase.

F. Project Title

The project title shall be clearly shown.

G. Legend of Symbols

Provide City of Fayetteville standard symbols for all appurtenances related to each type of facility. The standard legend may be expanded as necessary to fit specific projects

3.3.2 Grading and SWPPP

These Plan sheets shall be drawn at a legible scale (1"=10' to 1"=50') which will clearly convey design and construction intent. All erosion control devices (temporary and long term) shall be included, as well as revegetation methods with specific notes. Plan must show grades of all drainage facilities. All grading plans shall meet the requirements as described in Chapter 169 of the Unified Development Code. The SWPPP shall meet all ADEQ requirements.

3.3.3 Street Improvements

The Plans shall include Plan and Profile views for each street (private or public) proposed in the development. Cross-section sheets are required for all roadways. All plans shall be produced at a scale that is completely legible for review and for construction. In addition to the requirements set forth elsewhere in these Minimum Street Standards, the following information shall be shown on all Roadway plans submitted for review and approval:

A. Street Plan View

The plan view shall include, but not be limited to, the following:

1. Existing and proposed Property and/or right-of-way lines, easements, and adjacent property owners names and addresses. Type and dimension of easement or tract is to be clearly labeled. Dimensions of Property and right-of-way lines are to be marked.
2. Survey lines and stationing lines shall normally be based on centerline of travel lanes; other profiles may be included but shall be referenced to centerline stationing. Stationing in cul-de-sacs shall be on the centerline to the center of the bulb with flowlines dimensioned within the bulb.
   Survey lines and stationing lines shall deviate from centerline of street to parallel the roadway for situations where two sides of a divided roadway are not parallel.
3. Stationing shall read in ascending order in the direction of the north arrow or to the right.
4. Roadways and Roadway names.
5. Existing utilities and structures (shown as phantom lines), including, but not limited to:
   a. Storm sewer and appurtenances.
   b. Ditches or swales.
   c. Bridges or culverts.
   d. Fence lines and gates.
   e. Water lines and appurtenances.
   f. Sewer lines and appurtenances.
   g. Curbs and gutters.

h. Pavement limits.
i. Telephone lines and appurtenances.
j. Electric lines, poles and appurtenances.
k. CATV lines and appurtenances.
l. Gas lines and appurtenances, etc.
m. Signs.
n. Guardrails.
o. Houses or other buildings.
p. Trees.
q. Driveways.

6. Critical elevation (flowline, invert of pipe, etc.) of all existing and proposed utility or drainage structures.
7. Storm drainage flow direction arrows, particularly at intersections and all high and low points.
8. Match lines, stations and consecutive sheet numbers, beginning with cover sheet.
9. Station and elevation of all horizontal curves including PI, PC's, PT's, etc.; high or low point and VPI/PVI of all vertical curves; existing and proposed, centerline bearings, distances, and complete curve data.
10. Curb return radii, existing and proposed. Stations and elevations of all curb returns at the gutter line; mid-point elevations and additional locations as necessary, flowline-flowline intersection elevations, corresponding centerline spot elevations and percent of grade from the P.C.R. to flowline-flowline intersections of all crosspans.
11. Centerline stations of all intersecting roadways.
12. Survey tie lines to section corners or quarter corners, consistent with that shown on the plat.
13. Intersections. Any roadway intersections shall include construction and lane details for the new construction and existing facilities for a minimum of 150 feet beyond the limits of construction.
14. Basis of plan view and profile elevations shall be the same, i.e., flowline and flowline, top of curb and bottom of curb, etc.
15. Cul-de-sacs. High point and grades shown with percent arrows at critical points (cross-slope and flow line).
16. Location of all proposed and existing sidewalk and/or trails.
17. Soil Boring Locations and CBR test locations (when available).
18. Location of all existing or proposed retaining walls.

B. Street Profile

Profiles shall include, but not be limited to, the following:

1. All streets shall be designed to show profile of center line.

2. Original ground (dashed) and design grade (heavy, solid). Both grades are to be plainly labeled for all centerline profiles.
3. Existing and design elevations shall be provided for the centerline.
4 Elevation and location of all utilities and storm sewer in the immediate vicinity of the construction shall be shown on the profile. Separate left and right profiles may be required for clarification when there are multiple utility or storm sewer lines.
5. Station and elevation of all vertical grade breaks.
6. Distance and grade between VPI's.
7. Vertical curves, when necessary, with VPI, VPC, and VPT, high or low point (if applicable) stations and elevations. All vertical curves shall be labeled with length of curve (L) and K=L/A where A is the algebraic difference in slopes, in percent.
8. Profiles for curb returns when requested.
9. Specify limits of typical sections and transitions.
10. Separate drainage profiles are required for off-site storm drainage.

C. Typical Street Section(s)

A typical street section shall be included in the Plans and shall show the following:

1. Pavement section type, width and thickness
2. Cross slope and crown
3. Location of profile grade (crown, center line, curb line)
4 Curbs and/or ditches/swales
5. Existing and proposed grades
6. Right of way width
7. Sidewalks and/or trails, where required
8. Landscaping, if required
9. Stationing limits for the typical section
10. Street name and classification
11. Parking, where required

D. Cross-Sections

Roadway Cross-Sections. Roadway cross-sections shall be provided at intervals deemed necessary by the City to effectively evaluate connection with the existing facilities, (typically every 50 feet horizontally, at intersections, transition points, driveways, storm sewer structures, etc…).

The cross-sections shall include the following:

1. Profile centerline including proposed and existing spot elevations,
2. Roadway width.
3. Right-of-way width.
4. Pavement cross slope.

5. Pavement thickness.
6. Curbs and/or ditches/swales.
7. Proposed and existing drainage and utilities in the right of way (size, material, elevation and location).
8. Street name.

E. Key Map

1. Clearly depict each sheet's relative position compared to the overall project. The Roadway or area that the design pertains to will be shaded.
2. Minimum scale is 1 inch = 500 feet, showing the location and name of all roadways within and adjacent to the proposed construction and all future roadways. Scale should be indicated. The key map should be oriented consistent with detail in the sheet, i.e., same north.

3.3.4 Street Improvements Details

All pertinent details related to street improvements shall be shown on a detail sheet (or sheets) for the Project. Standard City of Fayetteville Detail Sheets shall be included, along with standard AHTD detail sheets where work is planned with AHTD right of way.

3.3.5 Traffic Signing and Pavement Markings

All permanent and temporary traffic signing and pavement markings shall be shown on the signing and striping plan, with the existing and proposed street system used as the base layout. Locations of signs and pavement markings shall be indicated by station/offset, or other specific dimensions indicating exact locations. This sheet shall also contain any construction or application notes, (e.g., application temperatures, surface cleaning methods to be used prior to application, etc.).

A. Area Map

Separate signage and striping plans are to consist of an overall area map noting all specific use areas, such as schools, parks, recreation centers, library, commercial, industrial, fire zones, no-parking and designated parking.

B. Road Segment Pages

The pages following the area map are to be broken down into road segments, for notation of signage and striping details.

C. Signing Plan

The permanent signing plan should:

1. Show the general longitudinal location of each sign (horizontal offset and station).

2. Specify the sign legend and sign type (from MUTCD).
3. Specify the sign size.
4. Detail post and base dimensions and installation plan (showing sleeves, depth below surface, and materials used, according to City standards).
5. Specify the blank gauge of the sign.
6. Note the reflectorization provided.

D. Striping Plan

The striping plan must show:

1. Color and type.
2. Lane widths, taper lengths, storage lengths, etc.
3. Striping/skip interval.
4. Typical treatments for acceleration/deceleration lanes, turning lanes, and crosswalks.
5. Type of material (thermoplastic).
6. Station and offset or dimensions to all angle points, symbol locations, and line terminations.
7. Pedestrian crossings.

E. Traffic Control Plan

All temporary traffic control signage and striping for lane closures and detours shall be shown. Controls must be designed to meet all MUTCD standards.

CHAPTER 4 – STREET DESIGN AND TECHNICAL CRITERIA

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CHAPTER 4 – STREET DESIGN AND TECHNICAL CRITERIA

4.1 GENERAL

This chapter defines layout criteria and other design criteria that shall be followed for locating and designing all streets.

4.2 STREET LAYOUT REQUIREMENTS

The locations of Arterial and Collector streets shall be in accordance with the current Master Street Plan. Other streets shall be located in accordance with all other applicable street layout requirements.

4.2.1 Logical Placement and Extension

All streets shall have a logical relationship to the existing topography and to the location of existing or platted streets within adjacent properties. Certain streets within the project may need to be extended to the project boundary to provide for the future extension of the street through adjacent properties.

4.2.2 Master Planned Arterial and Collector Streets

The Master Street Plan shows the approximate locations of all Arterial streets and some Collector streets for the City and its Planning Area. The Master Street Plan shall be used for establishing approximate locations of these streets. The City Engineer shall hold approval authority for specific alignments for all Arterial and Collector streets.

4.2.3 Local Streets

Layout of new Local streets not covered by the Master Street Plan shall meet the needs of the specific development and satisfy all other specific requirements of this chapter and the access management requirements of Chapter 166 of the Unified Development Code. The City retains the authority for approval of the overall street layout.

A. Neighborhood Traffic Safety and Traffic Calming

A major component in street layout is neighborhood traffic safety. This is an essential transportation issue in the City of Fayetteville. Traffic calming is the implementation of physical and perceptual techniques intended to slow or divert traffic on existing or planned roadways. It is often a reactive approach to minimize high speeds and volumes of vehicular traffic. Significant efforts in traffic calming have been put forward on existing roadways and in the development of new roadways to limit traffic speeds and traffic volumes in

neighborhoods and to provide for safer travel for all modes of transportation including pedestrian, bicycle, and vehicular.

4.3 STREET CLASSIFICATIONS

Street cross sections shall meet the classifications as shown in the current City of Fayetteville Master Street Plan.

4.4 GENERAL DESIGN ELEMENTS

All streets shall be designed in accordance with design speeds specified for each street classification in **Table 4-1.** Where ranges are specified, the design speed shall be determined by the City Engineer.

Table 4-1
Technical Design Criteria

Design Element		Arterial		Collector	Local	Alley
		Principal	Minor			
Overall Design Parameters						
Design Speed (mph)		25-40	25-40	25-30	15-25	5-10
Target Speed (mph)*		25-40	25-40	25-30	15-25	5-10
Stopping Sight Distance		See Table 4-3				
Horizontal Alignment						
Minimum Centerline Radius (ft)		Design	Design	175	90	
Maximum Super-Elevation (%)		4	4	4	n/a	
Minimum Tangent between Curves or at Intersections (ft)		100	100	100	30	n/a
Vertical Alignment						
Maximum Centerline Grade (%)	Ordinary	8	8	8	10	10
	Hilly	8	8	12**	15**	15
Minimum Center Line Grade (%)		.5	.5	.5	.5	.5
Minimum K-values	Crest	50	50	30	20***	10
	Sag	50	50	40	30***	20
Intersection Design						
Minimum Sight Distance at Intersections		See Figure 4-1 and 4-1a				

* Through streets shall be designed to minimize excessive speeds. Traffic calming measures may be required by the City Engineer when a street design creates conditions where target speeds are expected to be exceeded due to horizontal and vertical alignment.

** These grades are allowed for a maximum distance of 300 feet.

*** In HHOD, K-values may be less than the minimum upon approval by the City Engineer.

4.4.1 Alignment

Horizontal and vertical street alignments should conform to existing land layout plus the following criteria:

A. Horizontal Alignment

On Arterial and Collector roadways, curve radii and tangents shall be as large as possible using the minimums only where necessary. All changes in direction shall be made using standard curves. Traffic calming measures may be required for relatively straight sections of local streets that encourage excessive speeds.

1. Horizontal Curve Radii. The minimum allowable centerline radii for horizontal curves shall be as designated in **Table 4-1**. For low speed, low volume subdivision streets with 90 degree turns, it may be appropriate to have a curve radius less than the minimum shown. These will be evaluated on a case by case basis and may be approved by the City Engineer. For these curves, a Knuckle design may be used to provide additional lot frontage around the curve (See Figure 4-2). Reverse and compound curves should be used only when a single radius curve will not work. For driver safety, compound curves shall have a ratio no greater than 1.5 where the value of the larger radius is divided by the smaller radius.
2. Minimum Tangent Length
   a. Intersection. Whenever a minor street intersects a street of higher classification, a tangent length (measured from the nearest gutter flowline of the intersected street to the point of curvature in the intersecting street) shall be provided for a safe sight distance and safe traffic operation. The minimum required tangent lengths indicated in **Table 4-1** apply to the minor leg(s) only. The angle of departure shall not exceed 10 degrees for the length of tangent.
   b. Reverse Curves. The tangent between reverse curves shall be no less than the length shown in **Table 4-1**. If the curve radii are at least 50% greater than the radii required by the design speed, the tangent sections may not be required depending on grades and topography. If the curves are superelevated, the superelevation transition lengths will determine the minimum length of tangent between reverse curves.
3. Consistent Radii. All curves along a local street segment shall be designed with radii that are approximately equal to provide consistency and minimize unexpected difficult or quick maneuvers for the driver.
4. Curves with Small Deflection Angles (10° or less). To reduce the appearance of kinks in the street, minimum lengths of curve shall be designed with minimum arc lengths as shown in **Table 4-2**.

Table 4- 2
Centerline Arc Lengths

Street Classification	Minimum Centerline Arc Length (ft.)
Arterial	400
Collector	300
Local	200

5. Horizontal Curves on Vertical Curves. For driver safety, horizontal curves shall not begin near the top of a crest vertical curve nor near the bottom of a sag vertical curve.
6. Coefficient of Friction. The coefficient of friction shall conform to the recommendations in Chapter 3 of the **AASHTO "Green Book."**
7. Joining Existing Improvements. Connection with existing streets shall be made to match the existing alignment of the existing improvements, in accordance with horizontal alignment criteria.
8. Lane Transitions. The lengths for the transition in the lane width or for the addition or reduction of the number of travel lanes shall be designed in accordance with AASHTO standards.

B. Vertical Alignment

1. Maximum and Minimum Grades for Streets. The maximum and minimum grades for specific street classifications are shown in **Table 4-1**. The centerline grade in the bulb of a cul-de-sac shall not exceed 3 percent (See **Figure 4-3**).
2. Minimum Flowline Grades. Minimum flowline grades for gutters shall be 0.50 percent, except the bulb of cul-de-sacs where the minimum shall be 1.0 percent (See **Figure 4-3**).
3. Requirements for Using Vertical Curves. Vertical curves are required for grade changes that exceed 1.0 percent. Both centerlines and the curb and gutter flowlines shall be designed with vertical curves to meet AASHTO requirements. A series of grade breaks may be used in lieu of a specified vertical curve as long as the series of breaks meet the vertical curve criteria in these Standards for the design speed. K-values for design shall conform to **Table 4-1.** In sag curves on flow line, the minimum grade requirement of 0.50 percent shall override the slope within the vertical curve.

4. Joining Existing Improvements. Connection with existing streets shall be made to match the existing grade of the existing streets, in accordance with vertical alignment criteria. (Grade breaks shall not exceed allowable.)
5. Vertical Clearance. Vertical clearance above a roadway is a minimum of 16.5 feet. Clearance may be higher in AHTD right of way. AHTD requirements will govern.
6. Intersection Approach Grades. Intersection approach grades are discussed in **Chapter 5, Intersections**.
7. Off-Site Continuance of Grade and Ground Lines. To assure that future street improvements will meet these Standards the future grade and ground lines of all streets, except cul-de-sacs, shall be continued for 100 feet beyond the proposed construction.
8. Master Residential Lot Grading Plan. Consideration should be given to the earthwork associated with the individual lot grading for finished floor elevations, driveway slopes, etc…

C. Sight Distance

Sight distance is the distance necessary for a vehicle operator to perform expected functions and be able to do so without causing a hazard for the driver or other vehicle operators for the specific design speed of the street. In no case shall the distance be less than the stopping sight distance. This includes visibility at intersections and higher volume driveways as well as around curves and roadside encroachments.

1. Stopping Sight Distance for Vertical Crest Curves. Stopping sight distance is calculated assuming the following:
   Object height is 2 feet above road surface and viewer's height is 3.5 feet above road surface.
2. Stopping Sight Distance on Horizontal Curves. Where an object off the pavement restricts sight distance, the minimum radius of curvature is determined by the stopping sight distance. In no case shall the stopping sight distance be less than as specified in **Table 4-3.** The sight distance design procedure shall assume a 6-foot high obstruction (as measured from actual finished grade) exists at all property lines except in the sight distance easements that may be required to preserve the needed sight distance.
   Stopping sight distance on horizontal curves is based upon lateral clearance from the inner edge of pavement to sight obstruction, for various radii of inner edge of pavement and design speeds. The position of the driver's eye and the object sighted shall be assumed to be 6 ft. from the inner edge of pavement, with the sight distance being measured along this arc. Minimum stopping sight distances are given in **Table 4-3**.

Table 4-3
Stopping Sight Distance

Design Speed (mph)	Stopping Sight Distance (ft)
20	125
25	150
30	200
35	250
40	275
45	325
50	400

From AASHTO **"Green Book"**
(For Intersection Sight- Distance, see **Figure 4-1.**)

3. Corner Sight Distance. The corner sight distance provides for vehicles to enter traffic and accelerate to the average running speed. Corner sight distance shall be measured as shown in **Figure 4-1**.
4. Intersection Sight Distance Triangles. All sight-distance triangles must be shown on the street plan/profile plans. All sight distances must be within the public right-of-way or a sight distance easement. The easement shall be dedicated to the City and be kept free of sight obstructions.
5. Sight Obstructions. Any object within the sight distance easement more than 30 inches above the flow line elevation of the adjacent street shall constitute a sight obstruction, and shall be removed or lowered. Such objects include but are not limited to berms, buildings, parked vehicles on private property, cut slopes, hedges, trees, bushes, utility cabinets or tall crops. Mailbox clusters must be installed a minimum of 2 feet from back of curb and not cause any sight obstruction. The City may limit parking to protect visibility. The sight distance shall be measured to the centerline of the closest through-lane in both directions. In no case shall any permanent object encroach into the line-of-sight of any part of the sight distance triangle.

4.4.2 Cross Slope

Cross slope on a pavement is provided to drain water from the street surface. The design of cross slope shall consider driver comfort and safety.

A. Minimum Cross Slope

A minimum cross slope on all streets shall be 2.0 percent. Minimum cross slope on reconstruction or overlays of existing roadways is 1.5 percent.

B. Maximum Allowable Cross Slope

Maximum allowable cross slope on all new construction shall be 3 percent. Maximum allowable cross slope on any reconstruction or overlays of existing roadways shall be 4 percent.

C. Cross Slope for Street Modifications

When widening an existing street or adding turn lanes to an existing street, the resulting cross slope of the widened portion shall be within the limits stated above and the new cross slope shall be no less than the existing cross slope. However, if the cross slope of the existing street exceeds the Standards then new curb and gutter shall be designed such that the existing pavement, when overlaid, will result in a straight line cross slope grade that meets these Standards. Alternatively, the existing pavement may be removed and reprofiled to comply with these Standards.

D. Cross Slope for Cul-de-Sacs

Refer to **Figure 4-6** for cul-de-sac bulb cross slopes.

4.4.3 Superelevation on Horizontal Curves

The purpose of superelevating a roadway is to maintain the riding comfort on smaller than standard curves. Superelevation may only be used when other means of design will not work and is subject to review and approval by the City Engineer. The following criteria shall be followed:

A. Where Superelevation Is Permitted

Superelevation may be allowed for curves on Arterial and Collector streets in order to reduce the minimum centerline radius. In no case shall superelevation exceed 4.0 percent cross slope. Superelevation shall not be used to reduce minimum radii on Local Streets.

B. Run-Out

When superelevation is used, the minimum run-out used entering and exiting the superelevated portion shall be 100 feet.

4.4.4 Design Speed

Each roadway classification has a specific design speed. See **Table 4-1.**

4.4.5 Curb Return Radii

The required curb return radii are defined in **Table 5-1,** unless otherwise approved or required by the City Engineer.

4.5 MEDIANS

4.5.1 Turn Lane and Access

The design of medians shall include the evaluation for needed turn lanes and accesses. For the minimum requirements of turn lanes, refer to **Chapter 5, Intersections**.

4.5.2 Drainage

Landscaped medians shall be provided with drainage facilities to handle sprinkler runoff and nuisance flows. Sprinklers shall be designed to prevent spray onto the pavement surface. A properly designed under drain system shall be required.

4.5.3 Nose

Vehicle tracking templates shall be used to determine the position of the median nose so that vehicles do not track onto the median. The minimum radius for nose curbs shall be 2 feet to back of curb. A Single Unit (SU) truck template should be used for the design vehicle.

4.5.4 Transitions

The ends of medians shall transition into turn lanes with a minimum radius of 100 feet. A change of directions must be accomplished with the use of radii. Angle points shall not be allowed. See **Figure 5-10.**

4.5.5 Objects

No permanent structures, including light poles, fire hydrants, etc., shall be placed within 5 feet of the travel lane or in any location that would obstruct sight distance except for structures as approved in these Standards. If a median streetlight is placed within 5 feet of the travel lane, the light must be a breakaway model.

4.6 NON-CONNECTIVE STREET ALIGNMENTS

4.6.1 Cul-de-Sacs

A. Permitted Locations.

Cul-de-sacs shall be used only where necessary. Cul-de-sacs are permitted only on Local Streets in conformance with **Chapter 166 of the U.D.C.**

B. Minimum Radius

The cul-de-sac shall have a minimum radius of 50', or as required by the fire code.

4.6.2 Knuckle

A. Permitted Locations

Knuckles may be permitted only on Local Streets that intersect Local Streets.

B. Permitted Lengths

Knuckles shall have a maximum radius as indicated in **Figure 4-2**.

4.6.3 Dead-End Streets

A. Temporary Dead-End Streets

Temporary dead-end streets will be permitted only on streets that have no direct access from adjoining property. Additionally, a temporary dead-end street shall be planned to extend into neighboring property during a later development phase or project. The road must be fully constructed to the property line. Refer to **Figure 4-4**.

B. Temporary Turnarounds

At locations where a temporary dead-end street exceeds 150 feet in length, a temporary turnaround shall be constructed. Refer to **Figure 4-5** for two layout options**.**

C. Temporary Turnaround Easements

All temporary turnarounds shall be constructed within an access Easement or street ROW. The Easement may be vacated by the City when the Easement is no longer necessary.

4.7 DRAINAGE SYSTEMS

4.7.1 Drainage

Drainage system design shall be in accordance with current City of Fayetteville Drainage Criteria Manual.

4.7.2 Underdrains

A. Controlling Groundwater

Under drains used for the purpose of controlling groundwater on private property may be constructed within public right-of-way. The system shall be private and must be maintained by viable private parties.

B. Protecting Right-of-way Improvements

Under drains constructed for the purpose of protecting public right-of-way improvements may be installed only if other means are not possible. The City shall own and maintain these systems.

C. Design Criteria

All Under drains covered by these Standards shall be designed to meet the following criteria:

1. Positive Outfall: Demonstrate that under drain has positive outfall for gravity drainage.
2. Groundwater Barriers: The system shall be designed such that clay cutoff walls are provided at boundaries of the development to preclude hydraulic communication with offsite utility trenches either upstream or downstream.
3. Filter Fabric: The under drain trench shall be lined with a filter fabric specifically selected in consideration of on-site soil conditions in order to minimize the invasion of fine soil particles into the bedding gravel.

4.7.3 Sidewalk Underdrain

Storm water from concentrated points of discharge shall not be allowed to flow over sidewalks, but shall drain to the roadway by use of a sidewalk underdrain or other methods approved by the City Engineer.

A sidewalk underdrain shall not be located within a curb ramp, curb cut, or driveway. Sidewalk underdrains shall only be allowed in special situations, on a case-by-case basis, as determined by the City Engineer. Sidewalk underdrain sections shall be constructed in accordance with **Figure 4-7.**

4.7.4 Crosspans

A. Basic Requirements

Crosspans for passing storm drainage flow across roadways shall be constructed at intersections along streets that have a slope of one percent or less. Crosspans shall be constructed as shown in **Figure 4-6**.

B. Dimensions and Depth

Crosspans shall be a minimum width of 2 feet and a 1-inch typical depth adjacent to all streets classifications.

C. Minimum Grade

Minimum grade on crosspans at flowline of pan shall be 0.5 percent.

4.7.5 Inlets

Refer to the Drainage Criteria Manual requirements for sizing of inlets. Inlets or inlet depressions should not be located in the curb return or in the ADA ramp location, but shall be located at or behind the tangent points of the curb returns. Inlets located in a sidewalk shall be integrated with sidewalks. The inlet access shall be flush with the sidewalk surface. No manholes, inlets, or other storm sewer facilities are allowed within handicap access ramps.

4.7.6 Waterway Crossings

All waterway crossings beneath and/or within the public right-of-way shall be designed to minimize maintenance requirements. The design shall maintain or increase the water velocity through the structure to minimize silting or provide other design elements to address this issue.

If the waterway crossing is designated as an area with a streamside protection zone, all requirements of U.D.C. Chapter 168.12 shall be met.

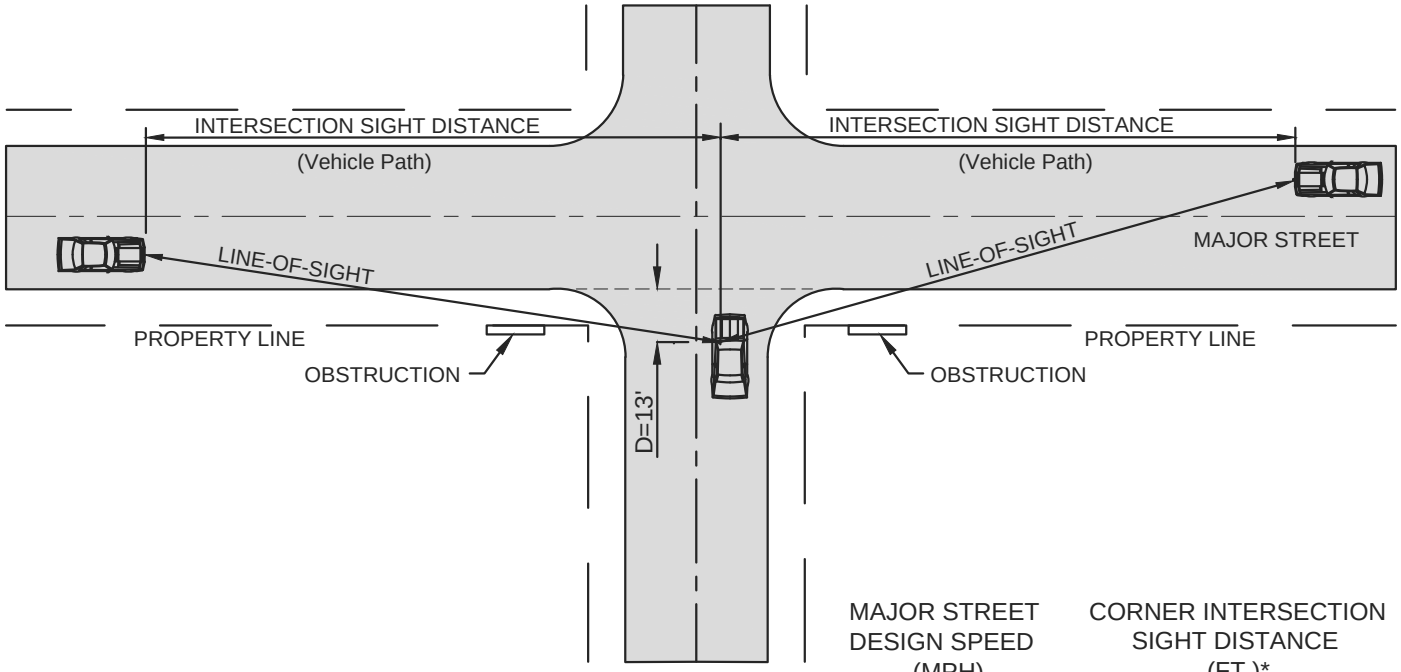
4.7.7 Roadside Ditches and Driveway Culverts

A. Roadside Ditches

Any roadway sections developed without curbs (and with roadside drainage ditches) must complete the ditch construction with the installation of sod or other approved erosion control blanket within the ditch area. The profile grade of the ditch shall be maintained at a minimum slope of one (1) percent and a maximum slope of five (5) percent. A ditch profile grade greater than 5% may be approved by the City Engineer if the ditch is permanently stabilized to prevent erosion. The side slopes of the ditches shall be a 3:1 slope or less with a 4’ wide shoulder between the edge of pavement and the top of slope.

B. Driveway Culverts

The slope and capacity of any roadside ditches shall be maintained in any areas that driveways cross the ditch. Each site is required to provide a pipe culvert a minimum of eighteen (18) inches in diameter, calculated to meet capacity and strength. The pipe shall be designed to have no less than twelve (12) inches of cover over the pipe. At each end of the culvert, there shall be a headwall or a flared end section installed. If a HDPE or CMP flared end section is used, a min. 6" wide concrete band shall be constructed around the exposed edges of the flared end section.



MAJOR STREET DESIGN SPEED (MPH)	CORNER INTERSECTION SIGHT DISTANCE (FT.)*
55	1240
50	1030
45	830
40	660
35	520
30	310
25	260
20	210
15	210

*NOTE: Line of Sight must be within R.O.W. or sight distance easement

1. Corner sight distance measured from a point on the minor road at 13 feet back from the edge of the travel lane (flowline) and measured from a height of eye at 3.50 feet on the minor road to a height of object at 3.5 feet on the major road.

2. At Local-Local street intersections only, the "D" distance shall be ten feet (10') and the sight distance shall be measured to the centerline of the street.

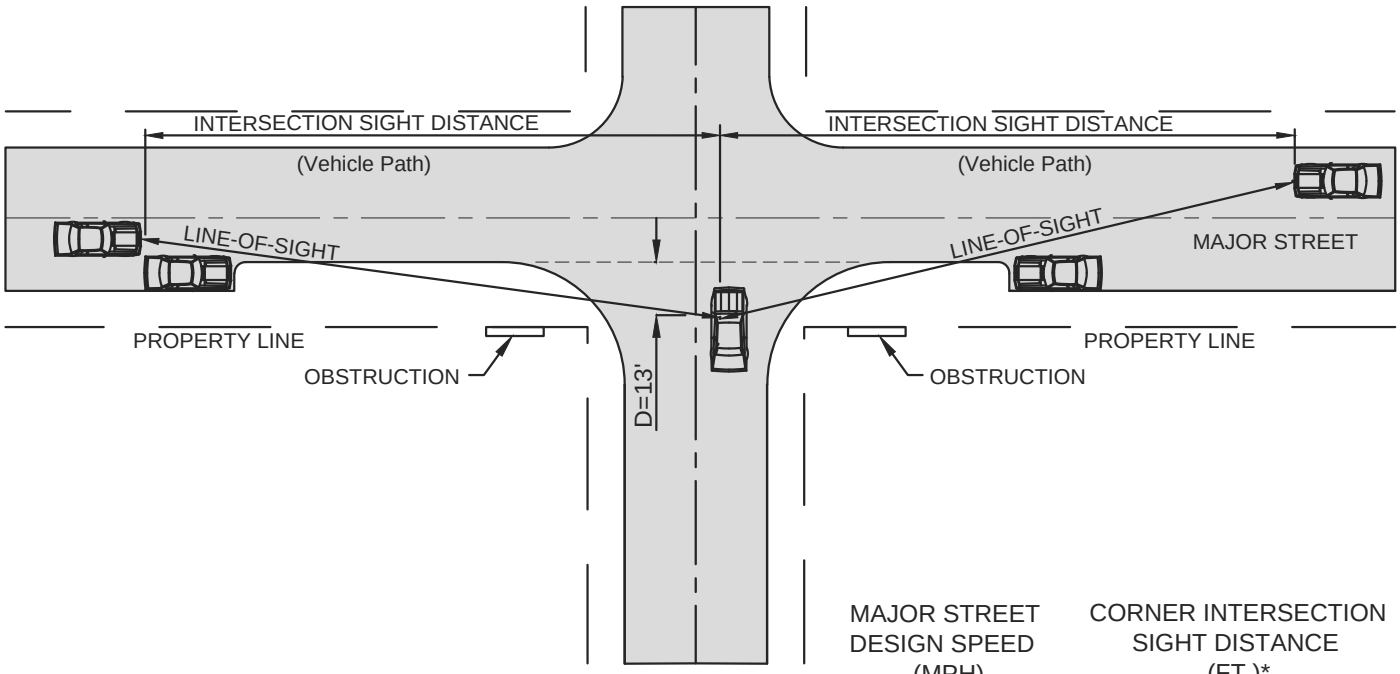
3. For private driveway access to a public street, use 10 feet back from flowline (or shoulder for gravel roads).

4. These values apply to passenger cars on 2-lane roads only. Intersections and access serving trucks or on multi-lane roadways requires separate analysis.

5. Adjustments may be required on a skewed intersection.

6. For local/local street intersection, the minimum sight distance allowed is the stopping sight distance. See Table 4-3.

SIGHT DISTANCE AT INTERSECTIONS
(Unsignalized)



MAJOR STREET DESIGN SPEED (MPH)	CORNER INTERSECTION SIGHT DISTANCE (FT.)*
55	1240
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NOTE: Line of Sight must be within R.O.W. or sight distance easement

1. Corner sight distance measured from a point on the minor road at 13 feet back from the edge of the travel lane (flowline) and measured from a height of eye at 3.50 feet on the minor road to a height of object at 3.5 feet on the major road.

2. At Local-Local street intersections only, the "D" distance shall be ten feet (10') and the sight distance shall be measured to the centerline of the street.

3. For private driveway access to a public street, use 10 feet back from flowline (or shoulder for gravel roads).

4. These values apply to passenger cars on 2-lane roads only. Intersections and access serving trucks or on multi-lane roadways requires separate analysis.

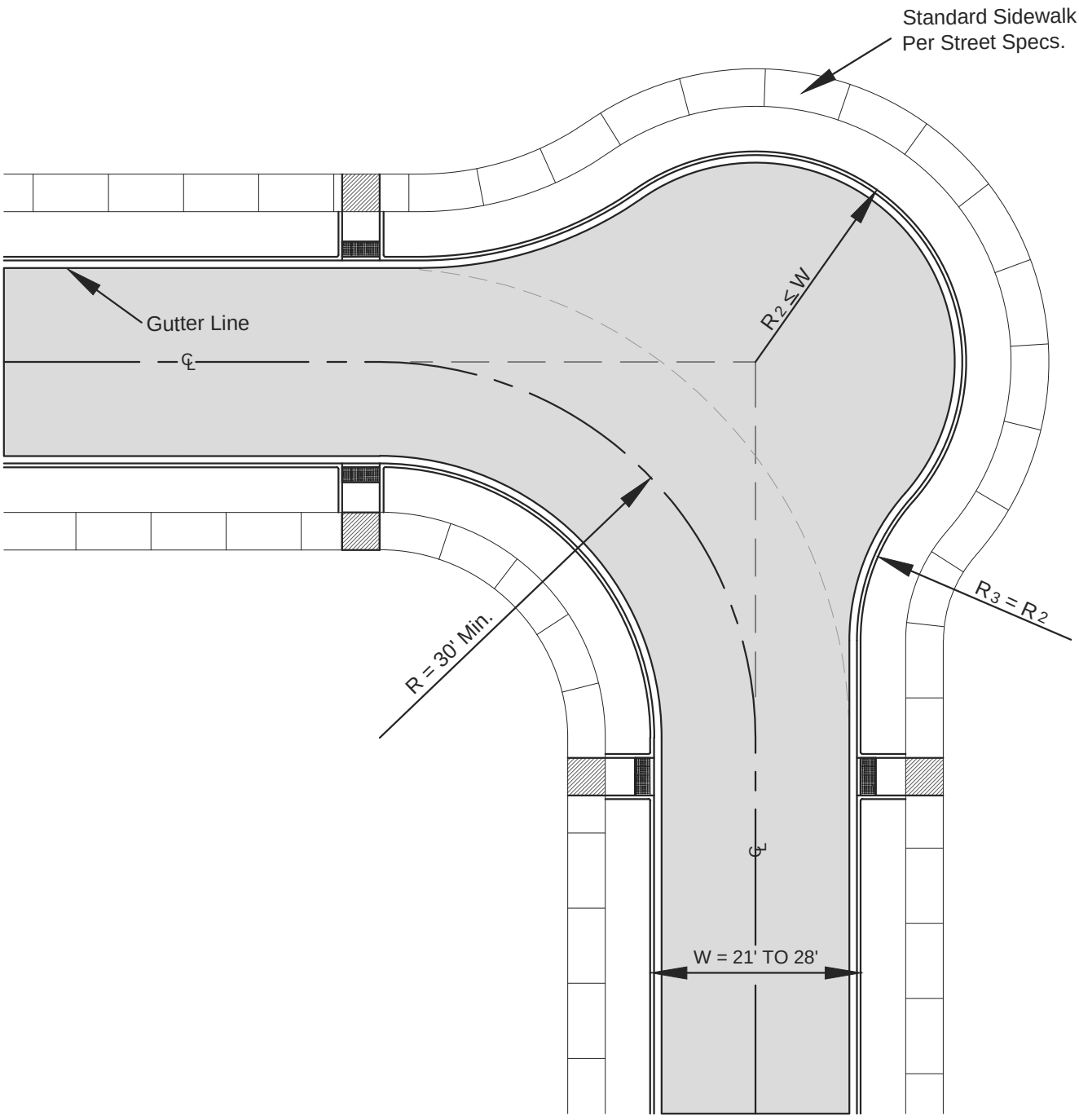
5. Adjustments may be required on a skewed intersection.

6. For local/local street intersection, the minimum sight distance allowed is the stopping sight distance. See Table 4-3.

SIGHT DISTANCE AT INTERSECTIONS
(Unsignalized)

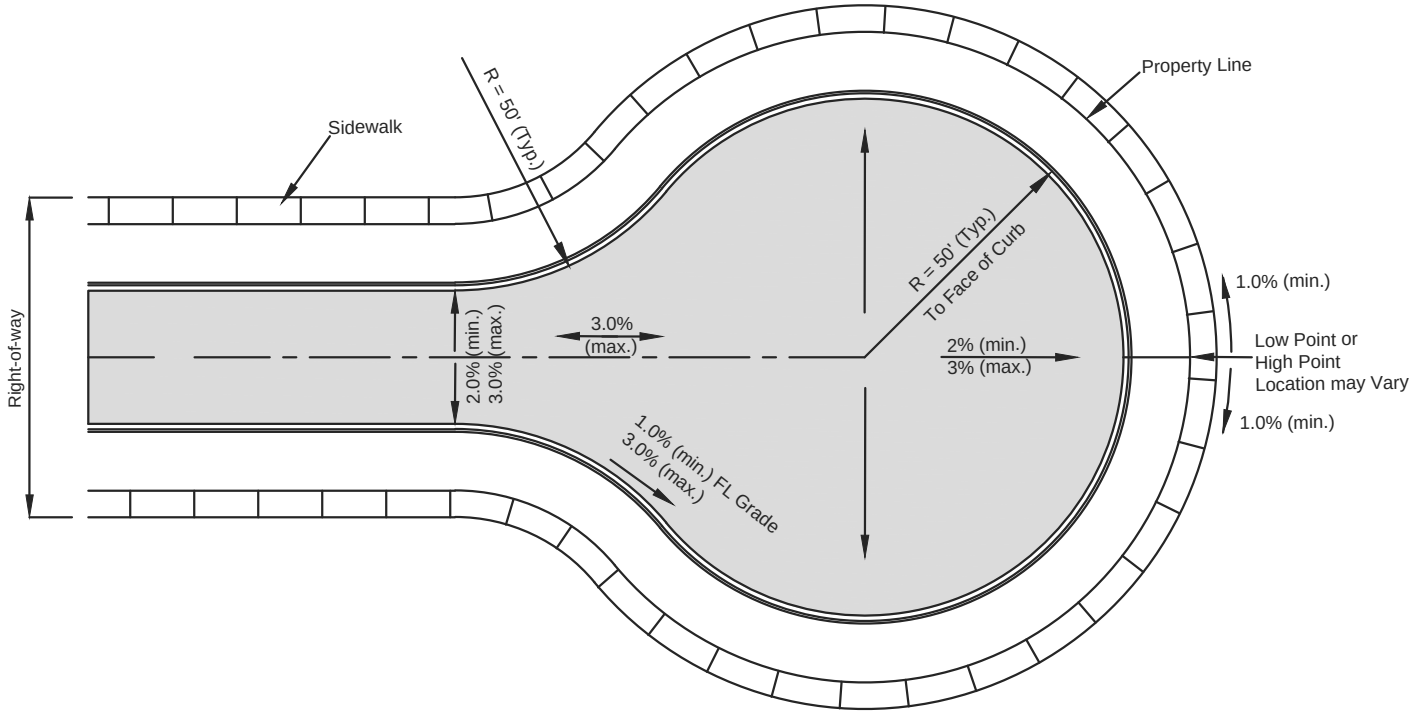
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE: ***MINIMUM STREET STANDARDS***
DATE: April 21, 2015
DESCRIPTION: SIGHT DISTANCE (SIGHT TRIANGLE) WITH ON-STREET PARKING
FIGURE: **4-1a**



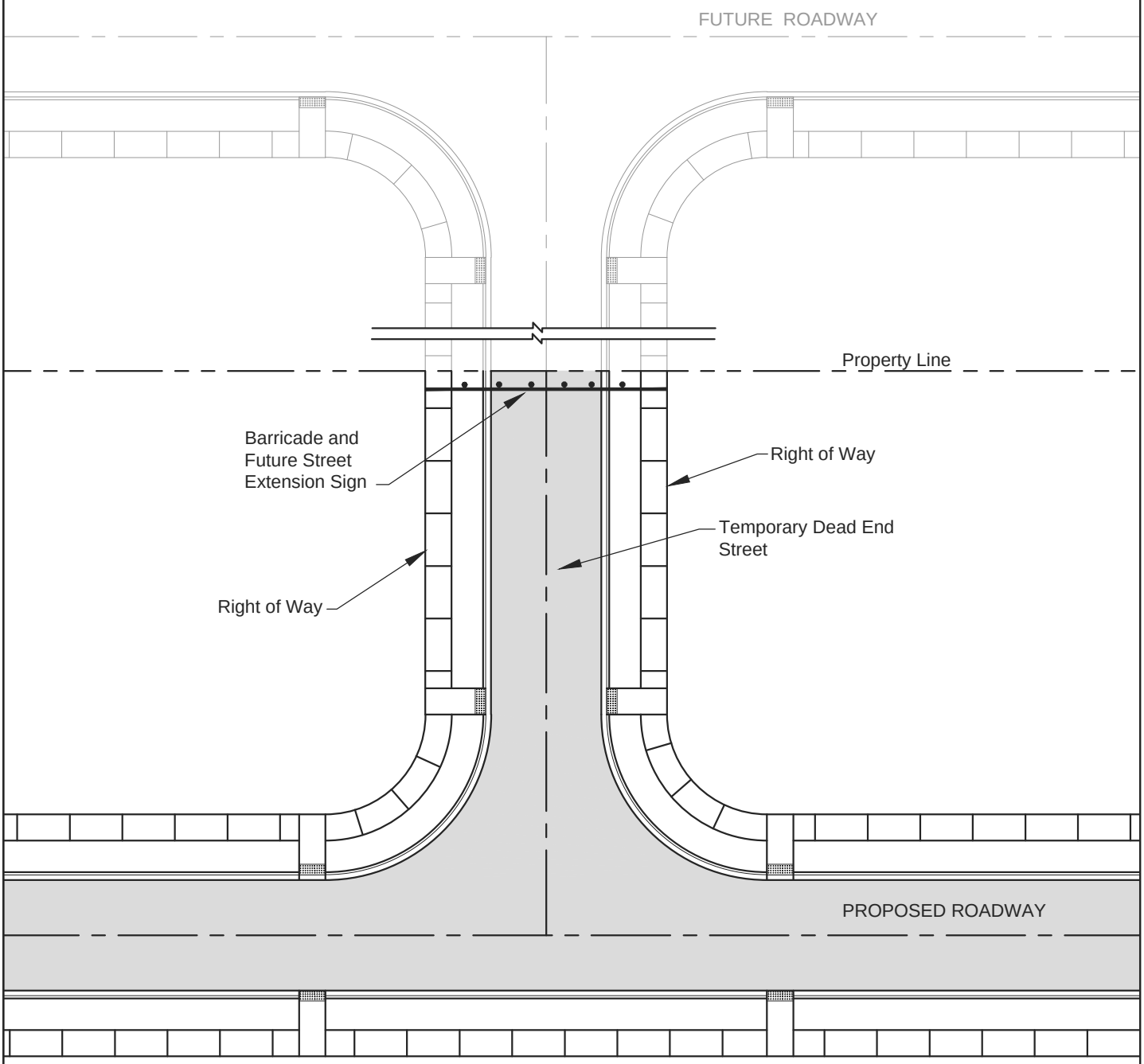
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE:	DATE:	FIGURE:
MINIMUM STREET STANDARDS	February 20, 2015	**4-2**
DESCRIPTION: KNUCKLE DETAIL (LOCAL STREETS ONLY)		



CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

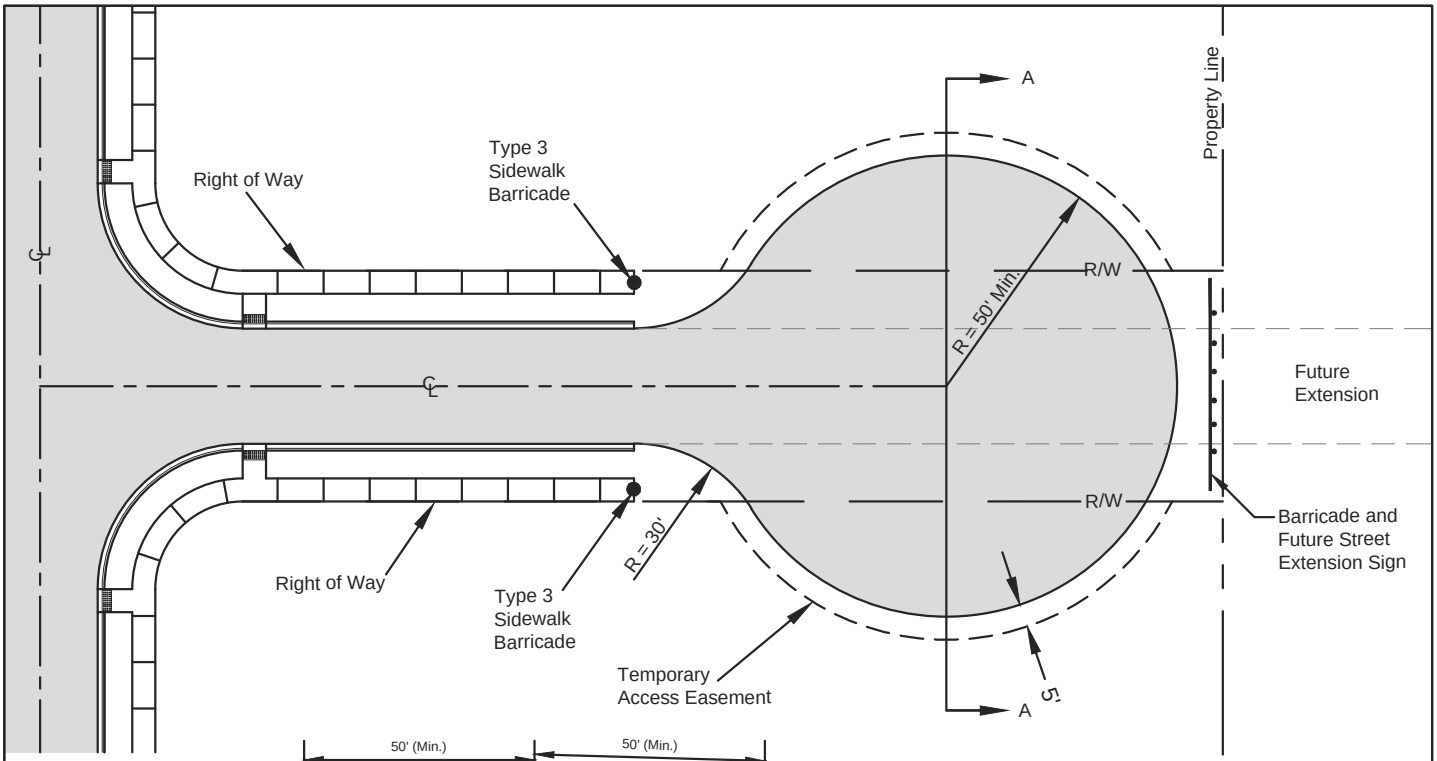
TITLE:	DATE:	FIGURE:
MINIMUM STREET STANDARDS	February 20, 2015	**4-3**
DESCRIPTION: CUL-DE-SAC DETAIL		

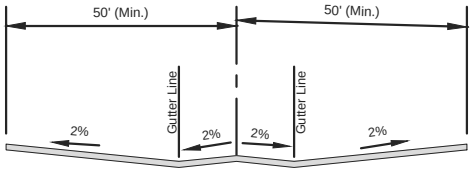


Notes:
1. The temporary dead end is limited to 150' in length.
2. A turnaround is not required.

CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

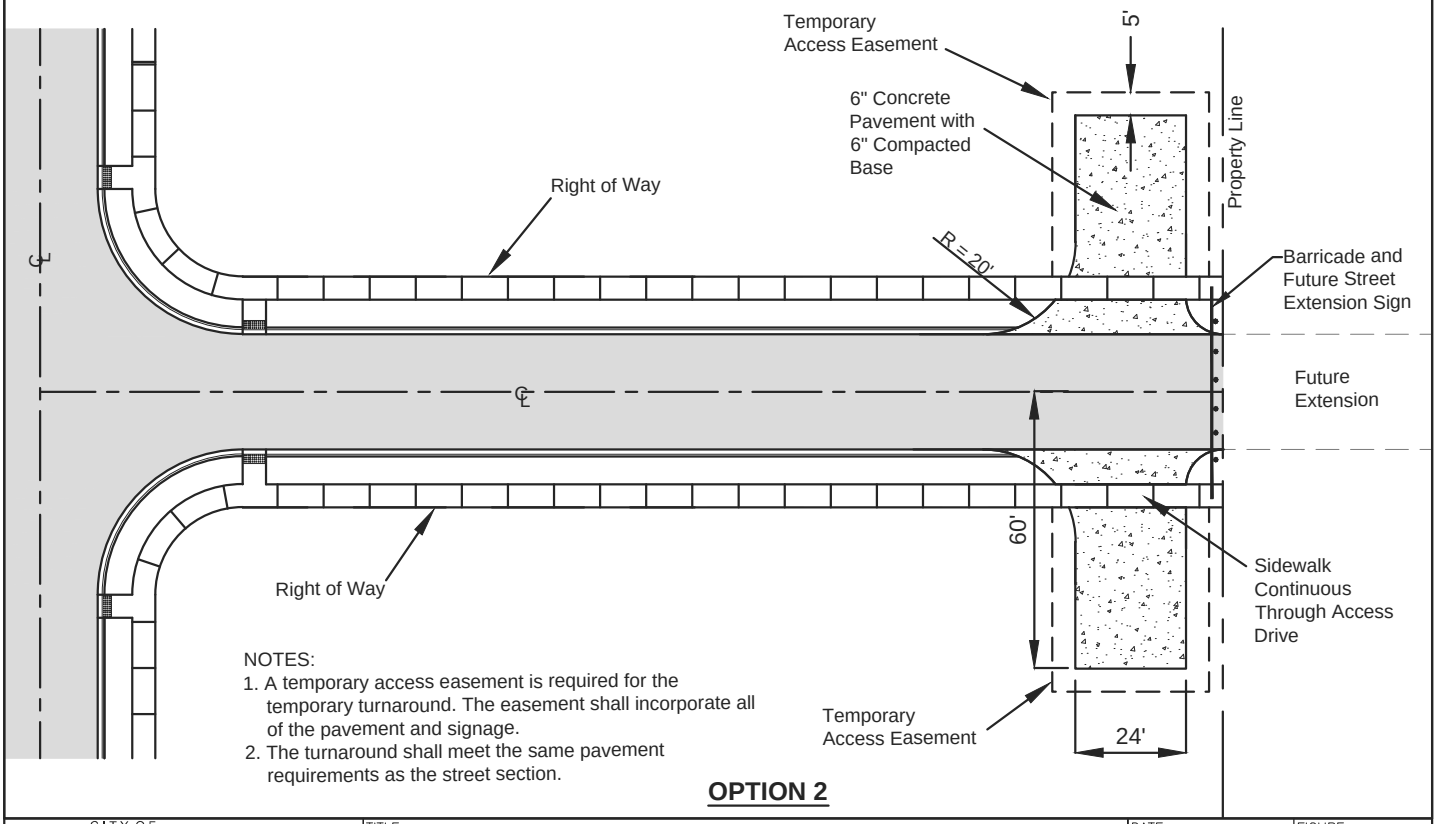
TITLE:	DATE:	FIGURE:
MINIMUM STREET STANDARDS	February 23, 2015	**4-4**
DESCRIPTION: STREET STUBOUT		





SECTION A-A

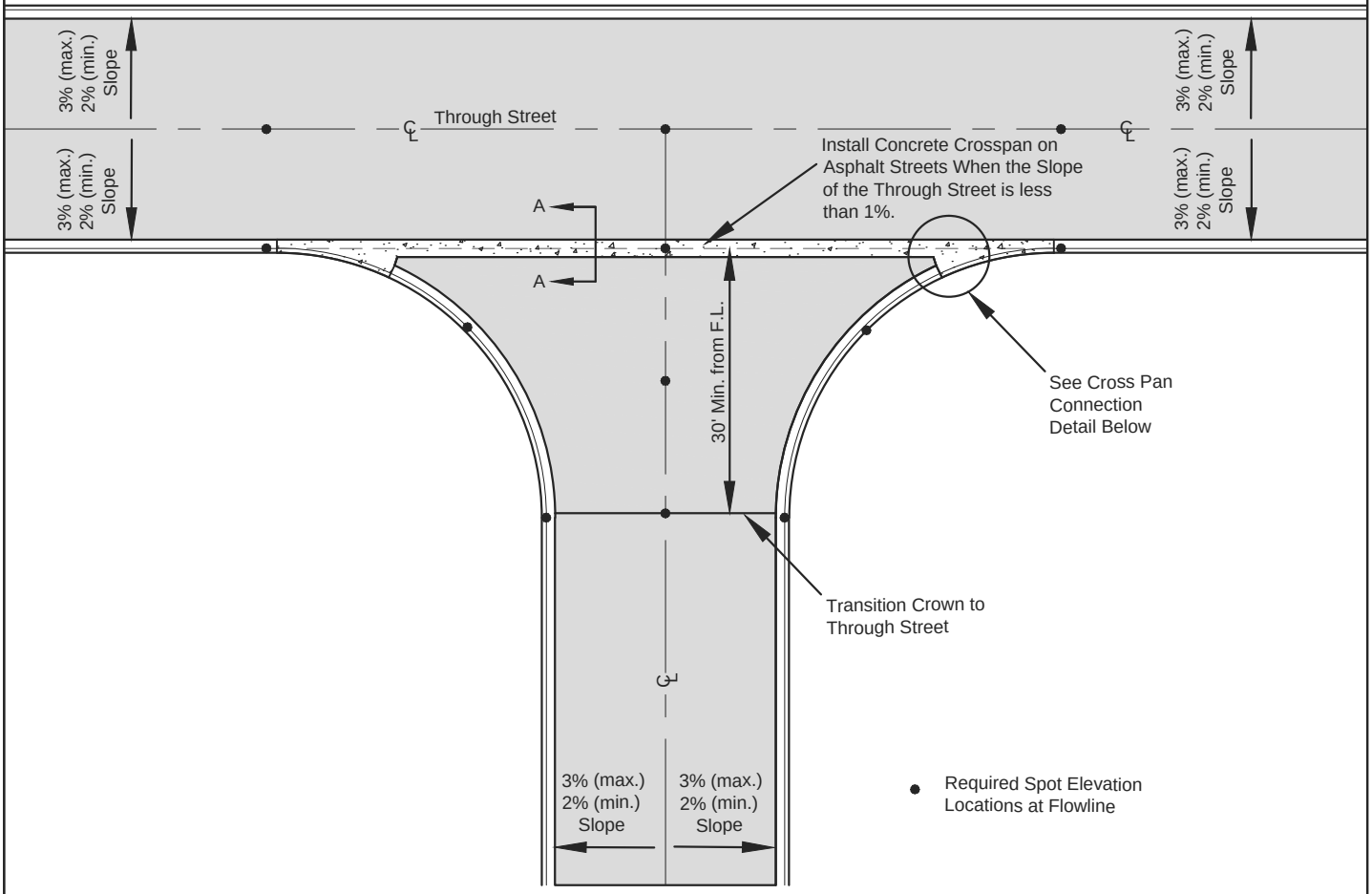
OPTION 1

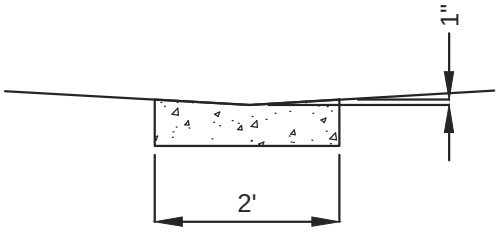


NOTES:
1. A temporary access easement is required for the temporary turnaround. The easement shall incorporate all of the pavement and signage.
2. The turnaround shall meet the same pavement requirements as the street section.

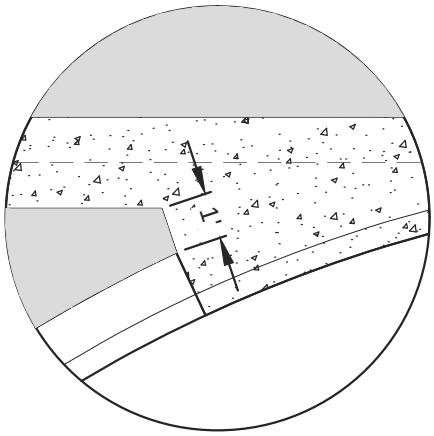
OPTION 2

CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: ***MINIMUM STREET STANDARDS***	DATE: February 23, 2015	FIGURE: **4-5**
	DESCRIPTION: TEMPORARY TURNAROUND		





SECTION A - A



CROSS PAN CONNECTION

CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: ***MINIMUM STREET STANDARDS***	DATE: February 23, 2015	FIGURE: **4-6**
	DESCRIPTION: STREET INTERSECTION APPROACH		

CHAPTER 5 – INTERSECTIONS

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LIST OF FIGURES

Figures are Located at End of Chapter

CHAPTER 5 – INTERSECTIONS

5.1 GENERAL

Intersections shall be designed to provide for the safety of motorists, pedestrians, and bicyclists. This chapter is based on criteria from the ITE Traffic Engineering Handbook, ITE Designing Walkable Urban Thoroughfares and AASHTO's A Policy on Geometric Design of Highways and Streets.

5.1.1 General Principals and Considerations

By their nature, intersections are conflict locations. Vehicles, pedestrians, and bicycles all cross paths. Each crossing is a conflict point. The basic design of intersections includes the following objectives:

A. Minimize conflicts between modes of transportation
B. Accommodate all modes with appropriate levels of service for motorists, pedestrians, bicyclists, and transit given the recommended speed, volume and expected mix of traffic.
C. Avoid elimination of any travel modes due to intersection design. Intersection widening for additional turn lanes to relieve traffic congestion should be balanced against impacts to pedestrians, bicyclists and transit.
D. Provide good driver and non-driver visibility through proper sight distance triangles and geometric features that increase visibility.
E. Minimize pedestrian exposure to moving traffic.
F. Avoid extreme intersection angles and break up complex intersections with pedestrian refuge islands. Keep intersections easily and fully comprehensible for all users. Strive for simplicity in intersection design.
G. Ensure intersections are fully accessible to the physically disabled.

5.2 INTERSECTION DESIGN CRITERIA

5.2.1 Location of Intersections

For intersection location criteria, refer to **Section 166.08 (Street Design and Access Management Standards)** of the U.D.C., and the current Master Street plan.

5.2.2 Lane Alignment

All lanes shall be in alignment through each intersection, with a maximum of a 2-foot shift in a hardship situation only, subject to approval by the City Engineer.

5.2.3 Angle of Intersection

Crossing roadways should intersect at 90 degrees whenever possible. In no case shall they intersect at less than 75 degrees or more than 105 degrees.

5.2.4 Horizontal Alignment and Vertical Profile

A. Horizontal

The horizontal alignment of streets through an intersection shall be designed in conformance with **Table 4-1.** Intersections may be placed on horizontal curves, provided that the tangent lengths given in **Table 4-1** are provided on the minor street and the required sight distance is obtained.

B. Vertical

The grade of the street with the higher classification shall prevail at intersections. The lesser street shall adapt to the grade of the Major street. When roads are of equal classification, the City Engineer shall determine which street grade prevails.

The street profile grade of the lesser street shall not exceed 5 percent on the approach to the intersection, as measured along the centerline of the street for a minimum distance equal to the tangent length for the street classification, see **Table 5-1**. In areas where steep terrain is an issue, the City Engineer may allow a greater approach grade in order to reduce the grading impact on the site.

5.2.5 Exclusive Left Turn Lanes

Exclusive left turn lanes shall be provided on all arterial streets and other streets wherever left turn lanes are warranted and approved by the City Engineer. The Designer shall use information in the Transportation Impact Study (TIS) to determine whether an exclusive left turn lane is warranted on non-arterial streets. Refer to **Figures 5.2, 5.3 and 5.4** for design requirements.

5.2.6 Exclusive Right Turn Lanes

Exclusive right turn lanes shall be provided at locations where they are required by the applicable TIS, and approved by the City Engineer.

A. Warrants for Right Turn Lanes

Figure 5-5 provides guidelines and warrants for whether a right turn lane shall be provided at intersections or accesses.

B. Design Criteria

Right turn lanes shall be designed to accomplish the following functions:

1. Provide a means of safe deceleration outside the high speed through lane.
2. Provide a separate storage area for right turns to assist in the optimization of traffic signal phasing.
3. Provide a means of separating right turn movements at stop controlled intersections. The design elements, as shown in **Figure 5-6**, are the approach taper, bay taper, lengths of lanes, width of lanes, and departure taper. For approach taper lengths, see **Figure 5-7**.

C. Pedestrian Refuge

Where Pedestrian refuge is required, it shall be designed in accordance with **Figure 5-8**. If a right turn lane turns into an exclusive lane that continues, use **Figure 5-9**

5.2.7 Design Vehicles

As a minimum, intersections shall be designed to accommodate the following design vehicles for the specified turns. The minimum allowable intersection turning radii are as follows.

A. DL-23 (Delivery Truck)

All DL-23 vehicles must be able to turn easily from one street to the next and remain in the correct lane for each roadway. This is required for all roadways.

B. SU-30 (Single Unit Truck)

All SU-30 vehicles must be able to turn easily from one street to the next and remain in the correct lane for each roadway. For low traffic Local/Local intersections, the SU-30 may use more than one traffic lane to complete the turn without tracking onto the curb at corners. For all other roadways this vehicle must be able to complete turns without entering into opposing lanes.

C. CITY-BUS (City Transit Bus)

All CITY-BUS vehicles may use more than one traffic lane to complete the turn when turning from the correct lane without tracking onto the curb at corners. This shall apply to all streets. When the intersection is on a regular or planned transit route where the turning movement could conflict with a stopped vehicle at the intersection, then the intersection must be designed to allow the bus to turn easily from one street to the next without entering opposing lanes of either roadway.

D. WB-40 (Intermediate Semitrailer)

All WB-40 vehicles may use more than one traffic lane to complete the turn without tracking onto the curb at corners. In addition, the vehicle must make the turn in one forward maneuver not encroaching into opposing traffic lanes unless the intersection has been designed to allow for safe encroachment. This requirement shall apply to all Arterial/Arterial, Arterial/Collector, Arterial/Local and Collector/Collector. For all other intersections (including mini-roundabouts), the vehicles may use the entire paved surface of the street to negotiate the turn. The vehicle may have to back up to complete the turn.

E. WB-67 (Interstate Semitrailer).

All modern roundabouts and arterial intersections containing raised medians and channelizing islands shall be designed to accommodate a WB-67 vehicle.

F. Other Vehicles.

For special circumstances other design vehicles may be required by the City Engineer.

5.2.8 Curb Returns

A. Curb Return Radii

The corner radii at intersections shall be set so that the selected design vehicles can pass through the intersection in an appropriate manner. The design vehicle types and use of lanes shall be per Section 5.2.7. Intersections shall be designed to minimize curb radii while still accommodating the largest applicable design vehicle. The following should be considered when possible in order to minimize the curb return radii:

1. Bike lanes, on-street parking, and other facilities should be included to create an effective corner radius which accommodates the design vehicle. When on-street parking is used to establish an effective turning radius, the effective radius shall be delineated within the parking lane by an approved striping pattern, raised curb, or other approved traffic control device.
2. Traffic control devices should be arranged as to allow safe encroachment of infrequent vehicles into approaching lanes of traffic.
3. Compound radii should be used to minimize the crossing distance for pedestrians.
4. The outside vehicular lane should be widened through the intersection to increase the effective turning radius.

A variance from the above requirements and 5.2.7 may be approved by the City Engineer where:

1. High pedestrian volumes are present or reasonably anticipated.
2. Volumes of turning vehicles are low.
3. The design vehicle constitutes a very low proportion of the turning vehicles.
4. Occasional encroachment of the design vehicle beyond that provided in Section 5.2.7 is acceptable.
5. Occasional encroachment of turning school bus, moving van, or oversized delivery truck into an opposing lane is not acceptable.
6. Larger vehicles than those listed in 5.2.7 are expected to be frequent users of the street.

For curb returns on a State Highway, every effort shall be made to minimize curb radii through negotiation with AHTD while acknowledging **AHTD**'s curb radii requirements

supersede these Standards.

B. Curb Return Grades

The minimum allowable grade for flowlines around curb returns shall be no less than 0.5 percent. One percent (1%) minimum slope is recommended.

5.2.9 Traffic Islands.

The following is a list of different types of traffic islands:

A. Corner Islands Separating Right Turns

Standard corner islands may be used in Arterial/Arterial intersections to channelize traffic where required to provide pedestrian refuge or where required by the City Engineer. The corner islands shall be designed as raised islands in accordance with **Figures 5-8** or **5-9** for a right turn lane continuing to an exclusive lane or for a right turn lane stop condition, respectively. The striping shall be in accordance with the requirements of **Chapter 7**, **Traffic Control Devices**.

B. Median Islands Separating Opposing Traffic

Median islands are required at all Arterial/Arterial intersections. The length of the island shall include the appropriate approach taper, bay taper and length of lane required by these Standards, or supported by another approved resource standard. The design shall be in accordance with **Figure 5-10** and as follows:

1. No Obstruction. Medians must not obstruct the minimum left turn radius for the design vehicle(s).

2. Drainage. Landscaped medians shall include drainage facilities to handle sprinkler run-off and nuisance flows. When low maintenance landscaping is used in conjunction with trickle irrigation, drainage requirements may be waived and outfall curb and gutter should be used.
3. A pedestrian refuge area shall be provided at all pedestrian crossings.

C. Splitter Islands on Roundabouts

In modern roundabout designs, raised splitter islands shall be designed in accordance with Federal Highway Administration Roundabouts to direct traffic and provide pedestrian refuge.

5.2.10 Traffic Signals, Striping and Signing

See Chapter 7, Traffic Control Devices.

5.2.11 Access Ramps

See **Chapter 8, Pedestrian Facilities Design and Technical Criteria**.

5.2.12 Right-of-way

A. Requirements

All intersection rights-of-way shall be dedicated as shown in the current **Master Street Plan** to provide adequate right-of-way to include greenspace, sidewalks, and access ramps around the radii. Additional right-of-way may be required at intersections to provide space for additional left or right turn lanes without reducing the widths of standard required facilities.

5.2.13 Intersection Sight Distance

Street intersections shall be designed so that adequate sight distance is provided along all streets. The required sight distance shall be determined by the design speed and grades of the street and the acceleration rate of an average vehicle as prescribed below.

A. Minimum Requirements

All designs must provide minimum safe stopping sight distance in accordance with **Chapter 4, Street Design and Technical Criteria,** and **AASHTO**. In addition, for all streets that intersect with Arterial and Collector streets, the sight distance must be large enough to allow a vehicle to enter the street and accelerate to the average running speed without interfering with the traffic flow on the Arterial or Collector street.

B. Landscaping and Hardscaping

No landscaping or hardscaping higher than 30 inches above the flow line of the gutter shall be permitted within a corner cut that will block the line of sight for pedestrian visibility.

5.2.14 Pedestrian Requirements

See **Chapter 7, Traffic Control Devices**, concerning crosswalk requirements and **Chapter 8, Pedestrian Facilities Design and Technical Criteria**.

5.2.15 Drainage

See **Chapter 4, Street Design and Technical Criteria**, concerning drainage.

5.3 ROUNDABOUTS

Roundabouts shall be specially designed to the specific need on high traffic volume streets and used to improve traffic flow. Refer to **Federal Highway Administration, Roundabouts: An Informational Guide** for typical layout. Also refer to **Figure 5-11 and 5-12** for typical roundabout layout features. The following are certain minimum requirements:

5.3.1 Design Vehicle

Arterial and Collector Roundabouts shall be designed to accommodate WB-67 trucks. The design vehicle is to be accommodated by maintaining a 2-foot separation between the truck and the curb face. A truck apron shall be provided around the circulatory island. The WB-67 vehicle may use the truck apron for left turn movements and may use the truck apron for right-turn movements if necessary.

5.3.2 Design Speed

The design speed for a single-lane roundabout shall be 20-25 mph. The design speed for a multi-lane roundabout shall be 25 to 30 mph.

5.3.3 Horizontal Configuration

The roundabout layout shall be determined by the Design Engineer and approved by the City Engineer.

5.3.4 Roadway Width

The circulatory roadway width shall be a minimum of 1.0 to1.2 times the width of the widest entering roadway. This width may include the truck apron when approved by the City Engineer.

5.3.5 Truck Apron

1. The width of the truck apron shall be a minimum of 8-feet to allow for emergency or maintenance vehicles. The truck apron shall be constructed of a material different in appearance from the adjacent pavement to provide visual contrast. Final truck apron design shall be based on truck turning analysis plus a two-foot buffer. The designer shall provide a jointing pattern plan to control shrinkage cracking.
2. The truck apron shall have a 4% to 6% Cross Slope to allow utility and maintenance vehicles access and discourage any pedestrian use.
3. Curb for the truck aprons shall be a 6-inch mountable curb with a 1:1 slope face. No expansion material shall be specified between the back of curb and the truck apron.
4. Truck apron pavement thickness shall be developed with the Final Pavement Design and may required subgrade stabilization if swelling soils exist.

5.3.6 Pedestrian Access Ramps for Bikes

1. Bicycle traffic shall be assisted / encouraged to leave the roadway prior to the roundabout by construction of bicycle exit and re-entrance ramps.

5.3.7 Pedestrian Crossings

1. The pedestrian crossing through the splitter island shall be set back 25-feet from the yield line at the nose of the splitter island pending sight triangle analysis. The pedestrian crossing and ramps shall meet the ADA requirements for accessible pathways.
2. A 7 to 8-foot wide of pedestrian refuge opening shall be provided in the splitter island.
3. The pedestrian crossing shall cross both the entry and exit roads along a single tangent roughly perpendicular to the centerline of the splitter island as shown on **Figure 5-11**.
4. Pedestrian ramps shall be lined up directly with the crosswalk A two-foot wide truncated dome surface shall be located perpendicular to the pedestrian crossing at each location where pedestrians are designated to enter the traffic way including the splitter island refuge.
5. The pedestrian ramps and splitter island pedestrian refuge shall be contained by six-inch vertical curbs to give direction at the crossing as shown on **Figure 5-11**.

5.3.8 Drainage

1. All drainage within the roundabout shall drain away from the center island at a slope of 2% min. (1% min. for concrete). A crowned circulatory roadway shall be designed for all multi-lane roundabouts unless a variance is granted by the City Engineer.
2. No pavement swales or drainage crosspans shall be allowed to take storm drainage away from center island or across roundabout entry or exit alignments. Drainage directed to the roundabout from adjacent legs must be intercepted by storm drain inlets to minimize encroachment into the circulatory roadway.

5.3.9 Where Allowed

Roundabouts may be allowed on any roadway as approved by the City Engineer. Design engineers are encouraged to evaluate the appropriateness of roundabouts for intersections within proposed developments.

5.3.10 Design Software

The roundabout design shall be completed with the aid of computer software. Acceptable products include the latest versions of Auto Turn, ARCADY, RODEL or other software as approved by the City Engineer. VISSIM or other simulation software may be used for public presentation. The City Engineer is authorized to require the use of a specific software package when warranted by the needs of a specific intersection. The Design Engineer shall have specific knowledge of how to control the software and be able to demonstrate that understanding to the City Engineer.

5.3.11 Right-of-way

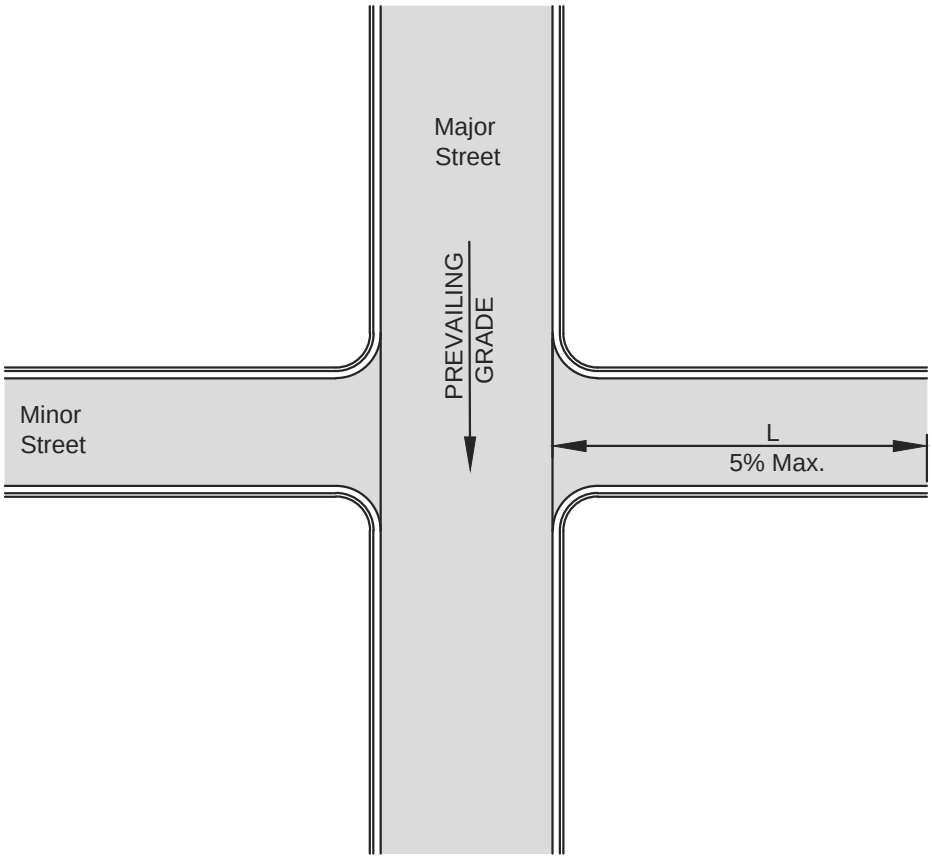
The City will require additional right-of-way to be dedicated by the Developer to accommodate the roundabout.

5.3.12 Splitter Islands

Raised splitter islands shall be required on all approaches. Where the approach leg has a central turning lane or median, the splitter island shall be extended to connect to the median or a sufficient distance from the pedestrian refuge to provide confinement of the enter ing and exit movements and control of the fastest paths (125-feet is suggested). The vertical face of the raised splitter island shall be set back approximately 3-feet from the approach edge of a median nose and 1 to 1.5-feet at the trailing edge (down traffic).

5.3.13 Signage

The signage shall be in accordance with **Chapter 7, Traffic Control Devices**.



INTERSECTION GRADE CONTROL LENGTHS (L)

MINOR LEG	LOCAL	COLLECTOR	ARTERIAL
Local	95 ft	100 ft	125 ft
Collector	100 ft	120 ft	200 ft
Arterial	125 ft	200 ft	200 ft

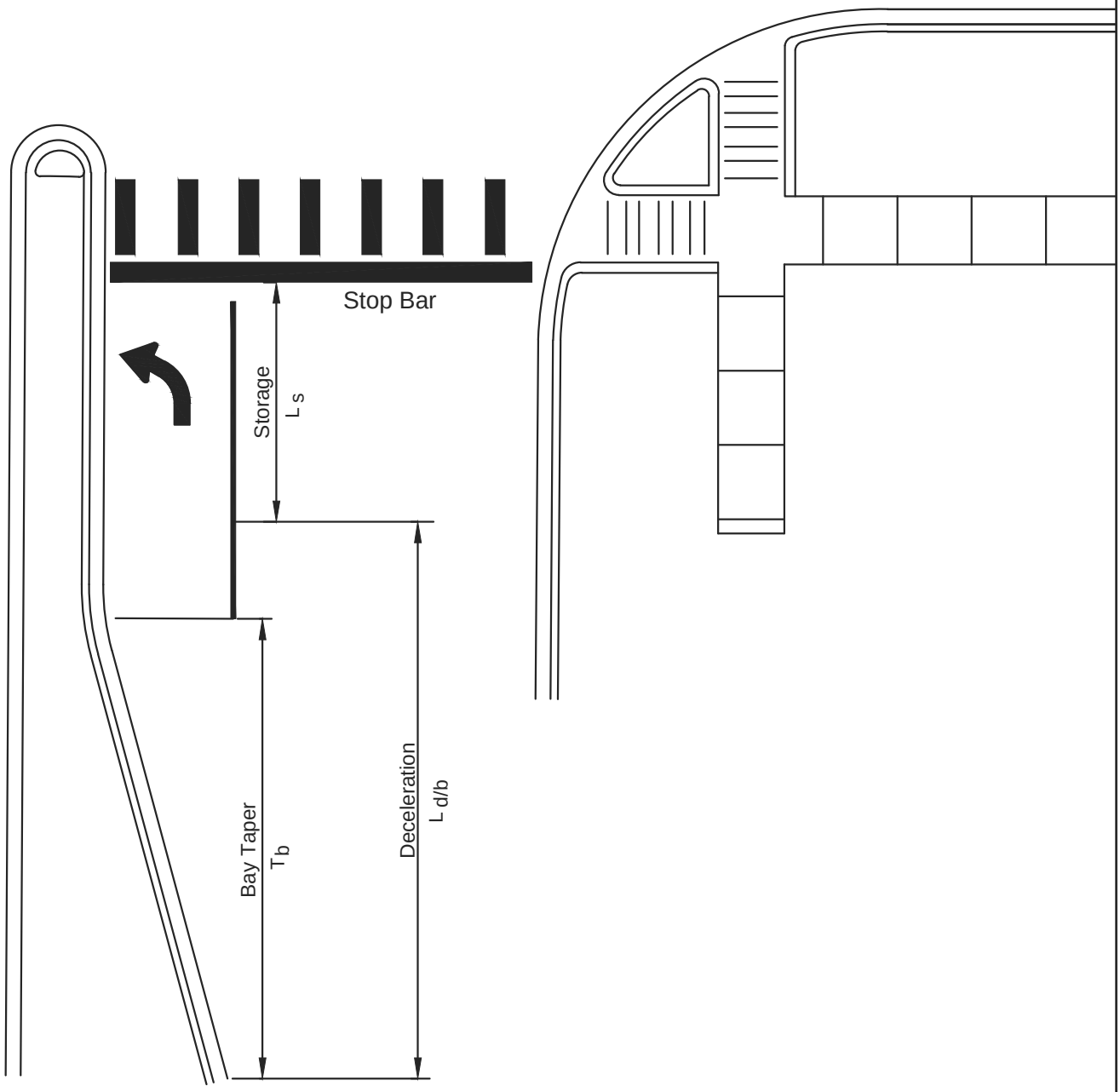
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE: ***MINIMUM STREET STANDARDS***

DATE: February 23, 2015

DESCRIPTION: INTERSECTION GRADES

FIGURE: **5-1**



NOTES:

1. Refer to **Figures 5-3, and 5-4** for design requirements.
2. Provide a 50± arc length at angle points for a smooth curve.

CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: ***MINIMUM STREET STANDARDS***	DATE: February 23, 2015	FIGURE: **5-2**
	DESCRIPTION: EXCLUSIVE LEFT TURN		

Deceleration

$L_{d/b}$ -- Length of Taper and Lane for Deceleration and Braking (ft.)

Functional Basis: To provide sufficient length for a vehicle to decelerate and brake entirely outside the through traffic lanes.

Desirable Design: Deceleration in gear for 3 seconds (occurs over bay taper) followed by comfortable braking to a stopped position. .

Design Values For $L_{d/b}$

S-- Speed (mph)	Total Length	Lane (ft)	Bay Taper
30	235	115	(120)
40	315	155	(160)
50	435	235	(200)
60	530	290	(240)

Minimum Design: Braking begins at 2/3 full lane width, with mimimum 50-foot storage. For low speeds only, the following values apply:

Design Values For $L_{d/b}$

S-- Speed (mph)	Total Length	Lane (ft)	Bay Taper
30	230	50	(180)
35	250	70	(180)
40	280	100	(180)
45	320	140	(180)

Storage

L_S -- Length of Lane for Storage (Full Width Lane) (ft.)

Functional Basis: To provide sufficient length for a reasonable number of vehicles to queue within the lane without affecting other lanes.

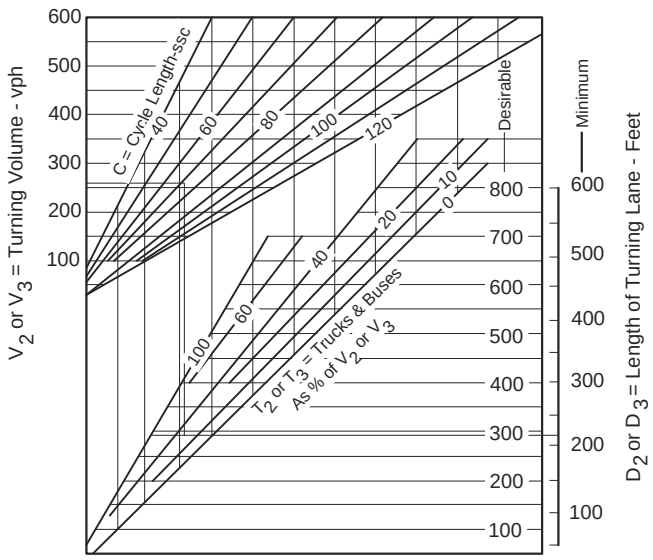
Desirable Design: Based on twice the mean arrival rate (per cycle for signals, per 2-minute period for stop control) during the peak hour of traffic.

Minimum Design: Based on mean arrival rate, with minimum storage for one vehicle.

L_S for Stop Control

DHV (vph)	L_S (ft)
≤60	50-75
61-120	100
121-180	150
>180	200 or more

L_S for Traffic Signal Control



CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE: ***MINIMUM STREET STANDARDS***

DATE: October 1, 2014

DESCRIPTION: GUIDELINES FOR DESIGN OF LEFT TURN LANES

FIGURE: **5-3**

T_a -- Approach Taper Design (ft) (Redirect Taper)

Functional Basis: To provide a smooth lateral transition for all vehicles approaching the intersection.

Form of Alignment: Tangent

Low Speed Design: (<45) Provide a fully shadowed lane.

$$T_a = \frac{W S^2}{60}$$

W = Width of Offset (ft)
S = Speed (mph)

Typical Values for T_a*

S-- Speed (mph)	W -- Width of Offset (ft) 11	11.5	12
25	115	120	125
30	165	170	180
35	225	235	245
40	295	305	320

*Rounded to nearesr 5 ft.

High Speed Design: (≤45) Provide a fully shadowed lane. Design as follows:

$$T_a = W S$$

W = Width of Offset (ft)
S = Speed (mph)

S-- Speed (mph)	W -- Width of Offset (ft) 11	11.5	12
45	495	520	540
50	550	575	600

*Rounded to nearest 5 ft.

T_b= Bay Taper Design

Functional Basis: To direct left-turning vehicles into the turn lane.

Form of Alignment: Tangent; or reverse curves with 1/3 of the total length comprised of a central tangent.

Desirable Design: For fully shadowed left turn lane.

$$T_b = \frac{W_1 S}{3}$$

W_1= Width of Lane
S = Speed (mph)

Typical Values for T_b*

S-- Speed (mph)	W_1-- Width of Lane (ft.) 11	12
30	110	120
40	145	160
50	185	200

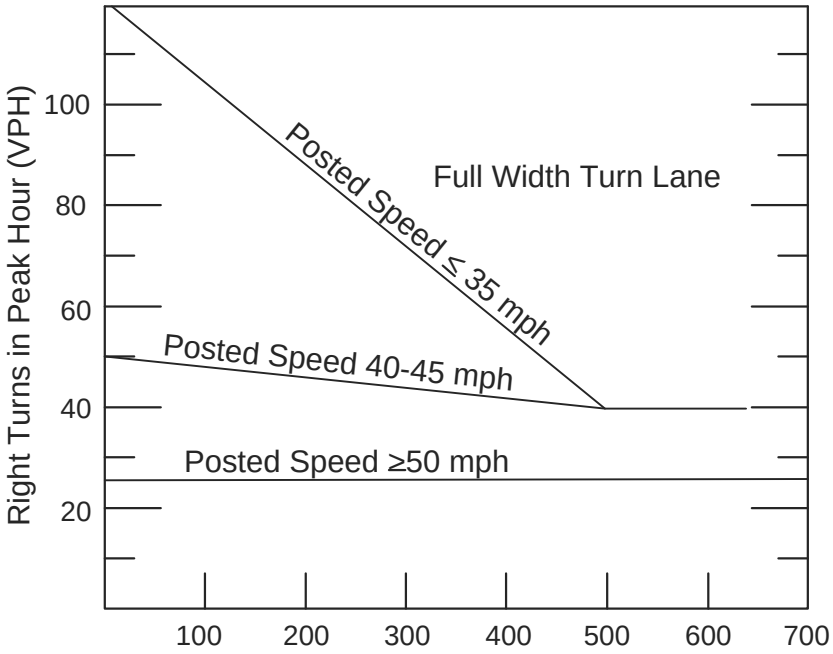
*Rounded to nearest 5 ft.

Minimum Design: Taper ratios of 8:1 can be used for tangent bay tapers in constrained locations.

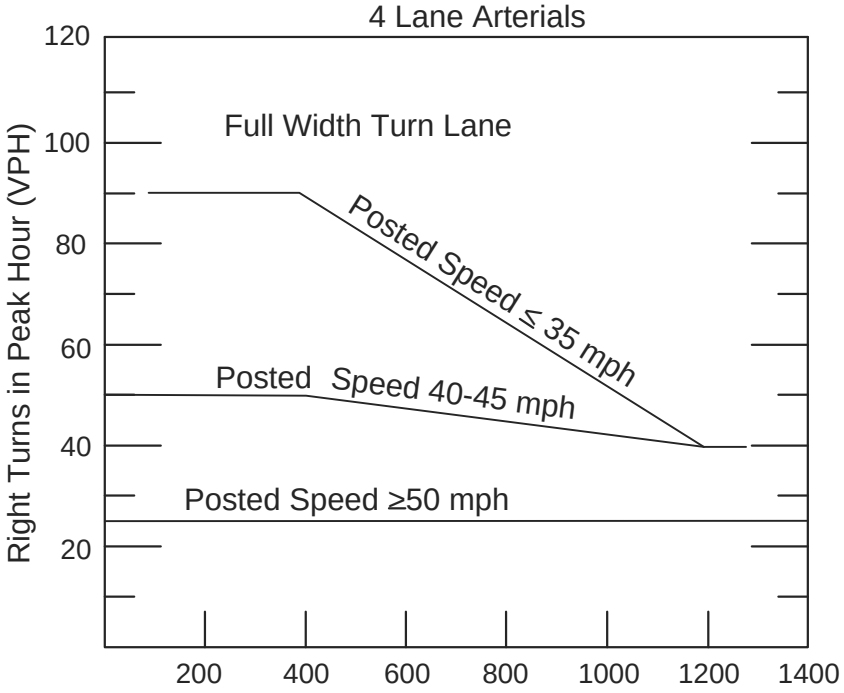
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE: ***MINIMUM STREET STANDARDS***
DATE: February 23, 2015
FIGURE: **5-4**
DESCRIPTION: GUIDELINES FOR DESIGN TAPERS OF LEFT TURN LANES

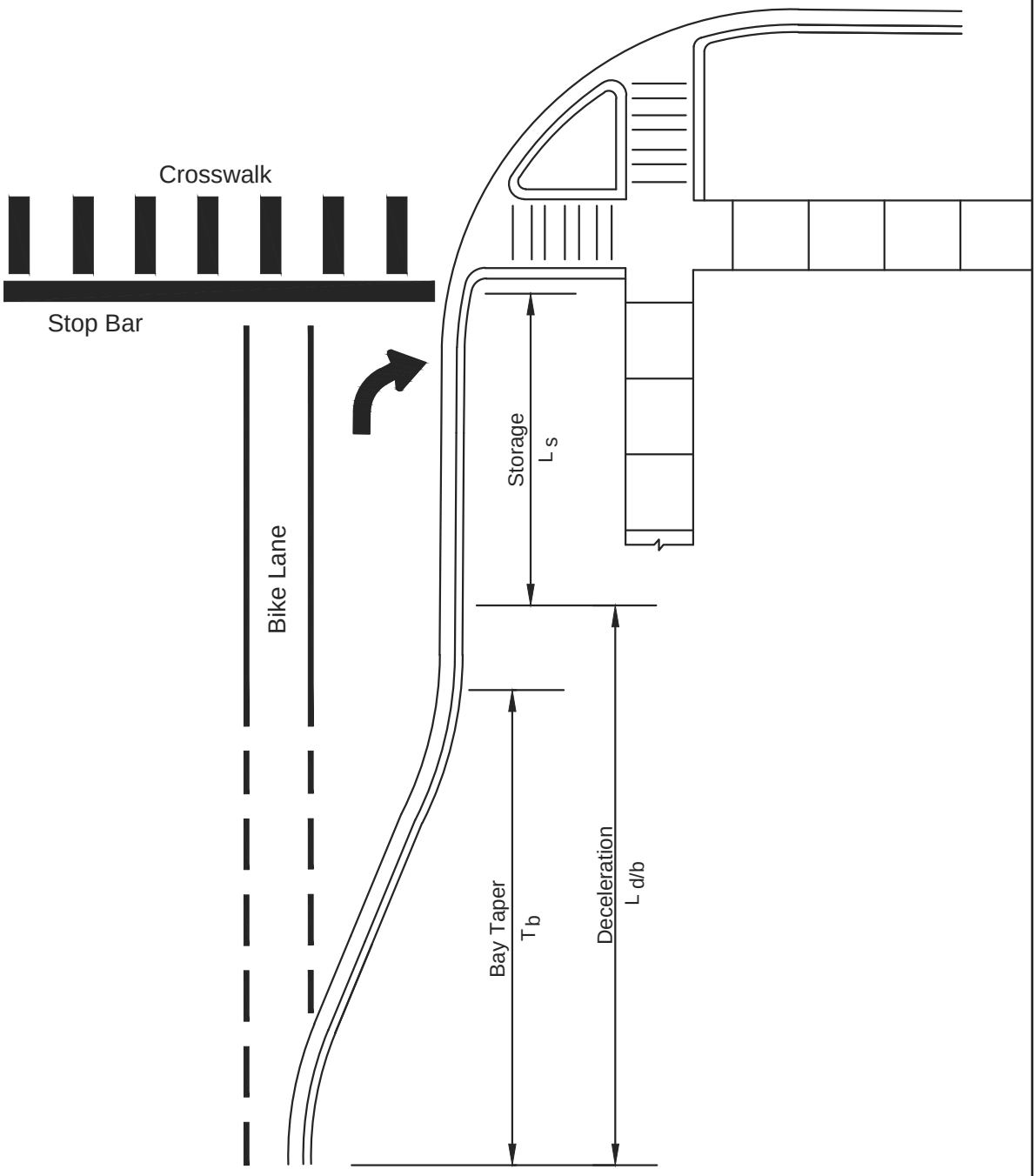
2-Lane Collectors or Arterials



4 Lane Arterials



CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: **MINIMUM STREET STANDARDS**	DATE: February 23, 2015	FIGURE: **5-5**
	DESCRIPTION: TRAFFIC VOLUME GUIDELINES FOR DESIGN OF RIGHT TURN LANES		



NOTES:
1. Refer to **Figures 5-7** for design requirements.
2. Provide a 50± arc length at angle points for a smooth curve.

CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: ***MINIMUM STREET STANDARDS***	DATE: February 23, 2015	FIGURE: **5-6**
	DESCRIPTION: EXCLUSIVE RIGHT TURN		

$L_{d/b}$ -- Length of Taper and Lane for Deceleration and Braking (ft.)

Functional Basis: To provide sufficient length for a vehicle to decelerate and brake entirely outside the through traffic lanes.

Desirable Design: Deceleration in gear for 3 seconds (occurs over bay taper) followed by comfortable braking to a stopped position.

Design Values For $L_{d/b}$

Highway Design Speed, V (mph)	Stop Conditions*	Design Speed of Corner Radius (mph) 15	20	25	30
30	235	185	160	140	-
35	275	240	213	188	93
40	315	295	265	235	185
45	375	350	325	295	250
50	435	405	385	355	315

* Approximate for right turn lanes in approaches to stop signs and traffic signals.

Bay Taper Length = $\frac{WS}{3}$

$T_b = \frac{W_1 S}{3}$

T_b= Bay Taper Design

Functional Basis: To direct left-turning vehicles into the turn lane.

Form of Alignment: Tangent; or reverse curves with 1/3 of the total length comprised of a central tangent.

Desirable Design: For fully shadowed left turn lane.

$T_b = \frac{W_1 S}{3}$

W_1= Width of Lane
S = Speed (mph)

Typical Values for T_b*

S-- Speed (mph)	W_1-- Width of Lane (ft.) 11	12
30	110	120
40	145	160
50	185	200

*Rounded to nearest 5 ft.

Minimum Design: Taper ratios of 8:1 can be used for tangent bay tapers in constrained locations.

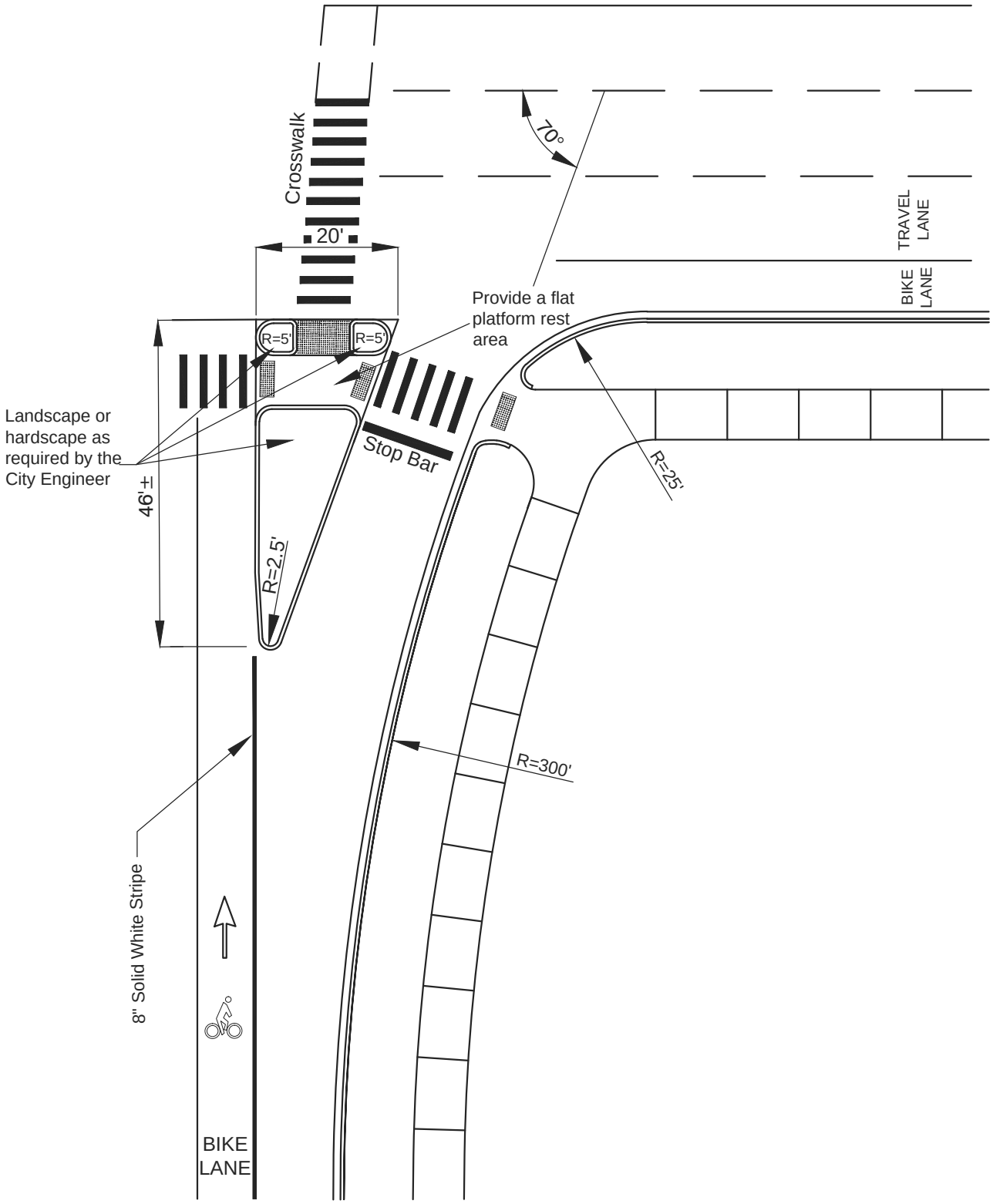
L_S -- Length of Lane for Storage (Full Width Lane) (ft.)

Functional Basis: To provide sufficient length for a reasonable number of vehicles to queue within the lane without affecting other lanes.

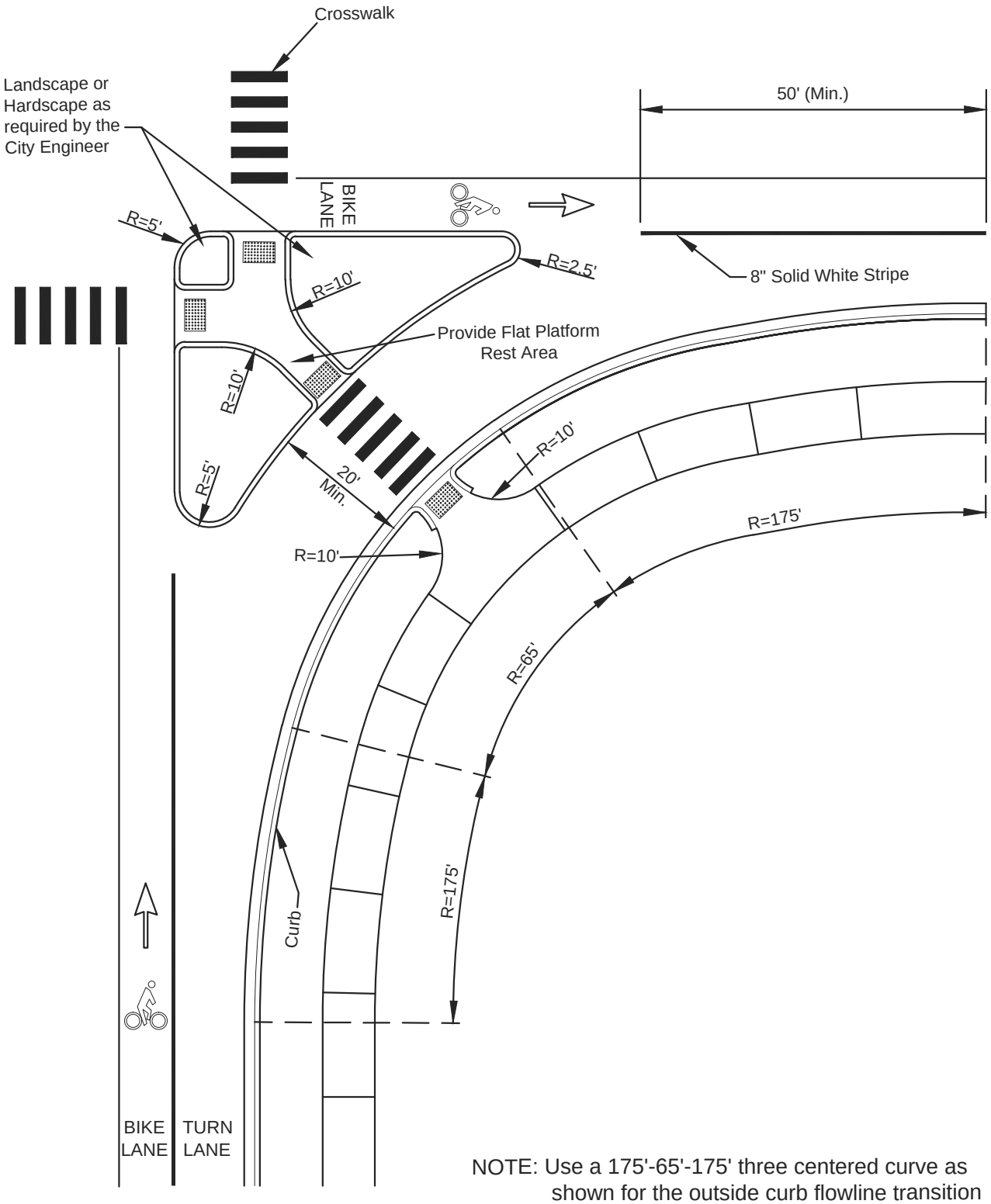
Desirable Design: Based on twice the mean arrival rate (per cycle for signals, per 2-minute period for stop control) during the peak hour of traffic.

Minimum Design: Based on mean arrival rate, with minimum storage for one vehicle.

L_S for Stop Control	
DHV (vph)	L_S (ft)
≤60	50-75
61-120	100
121-180	150
>180	200 or more



CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: ***MINIMUM STREET STANDARDS***	DATE: February 23, 2015	FIGURE: **5-8**
	DESCRIPTION: PEDESTRIAN REFUGE ISLAND/ RIGHT TURN LANE		

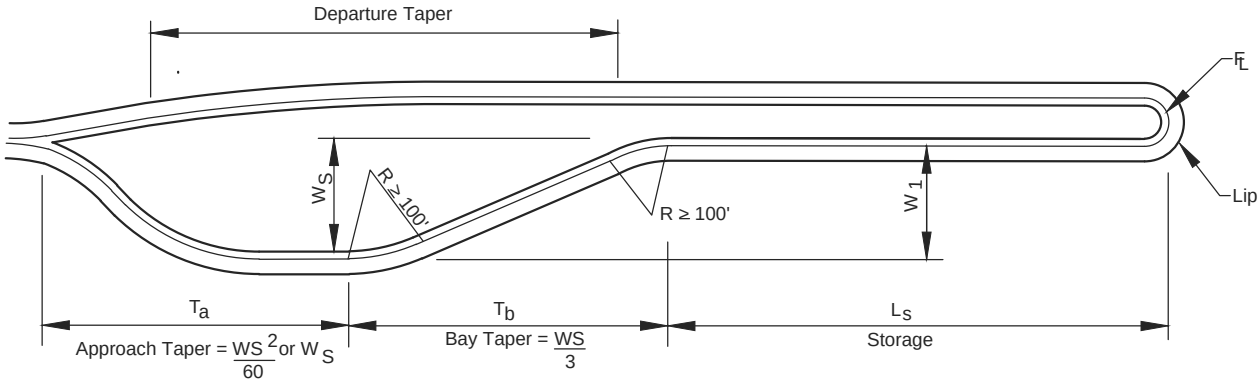


NOTE: Use a 175'-65'-175' three centered curve as shown for the outside curb flowline transition

CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

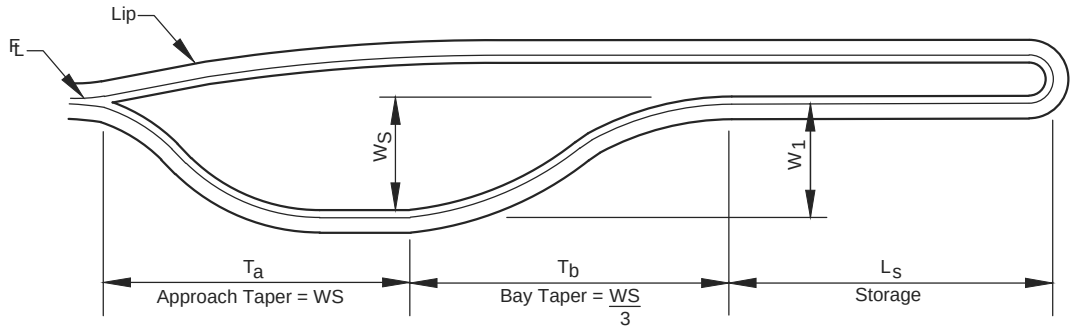
TITLE:	DATE:	FIGURE:
MINIMUM STREET STANDARDS	October 1, 2014	**5-9**

DESCRIPTION:
RIGHT TURN LANE TO A CONTINUOUS LANE W/ PEDESTRIAN REFUGE



Left Turn Lane with Full Shadow

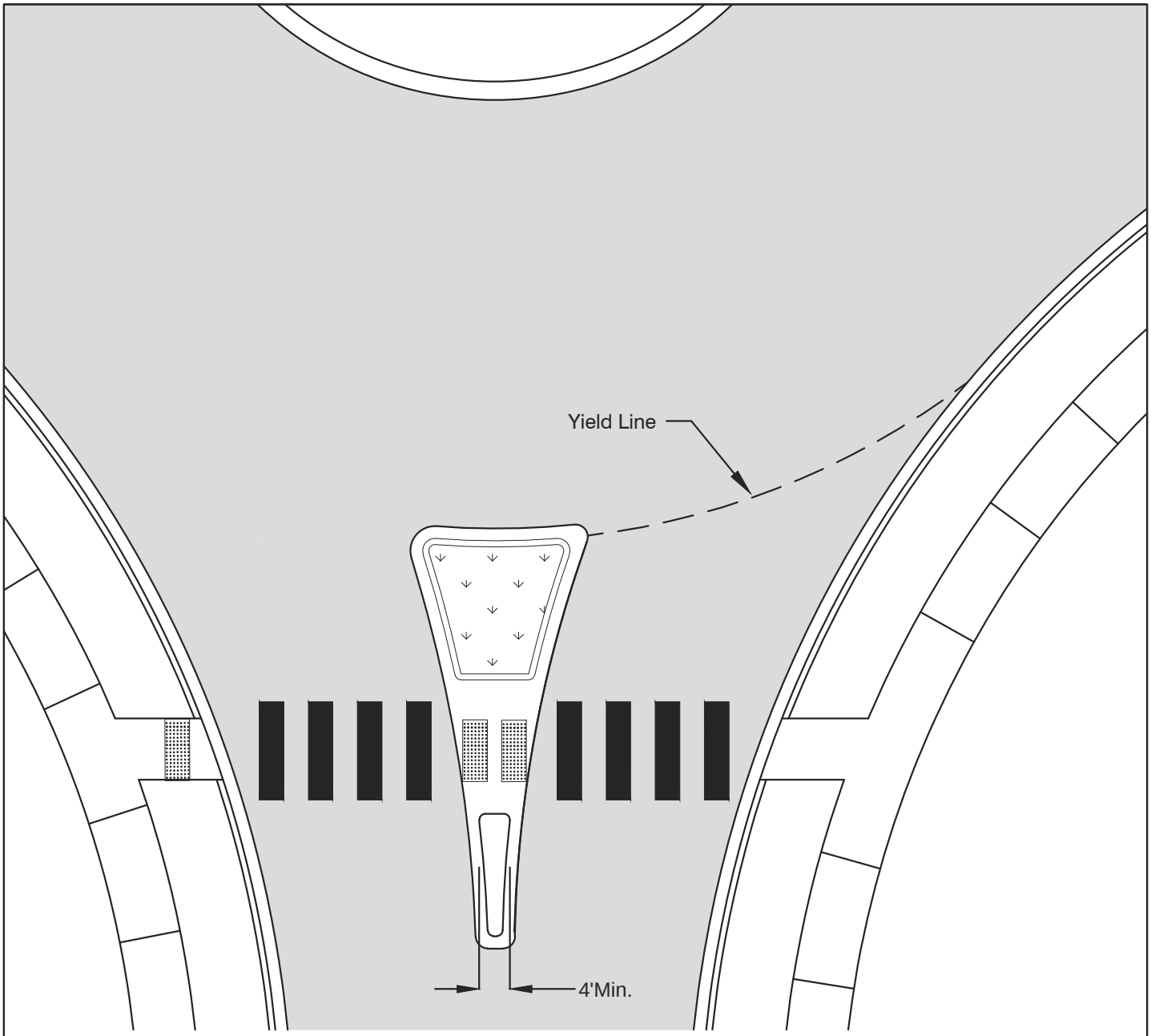
High Speed (≥ 45 MPH)



Left Turn Lane with Partial Shadow

TAPER RATIOS				
TAPER TYPE	DESIGN SPEED			
	35	40	45	50
Bay	12:1	13.3:1	15:1	16.7:1
Approach	20:1	27:1	45:1	50:1
Depart	NA	NA	NA	NA
Combined	20:1	27:1	45:1	50:1

NOTE: Refer to **Figure 5-4** for Design Requirements.



Notes:
1. Each Splitter Island shall have a minimum width equal to the street classification sidewalk width.
2. The specific design shall determine mimimum radii and island lengths.
3. Raised crosswalk may be required.
4. Designer shall provide design to drain water out of pedestrian refuge.

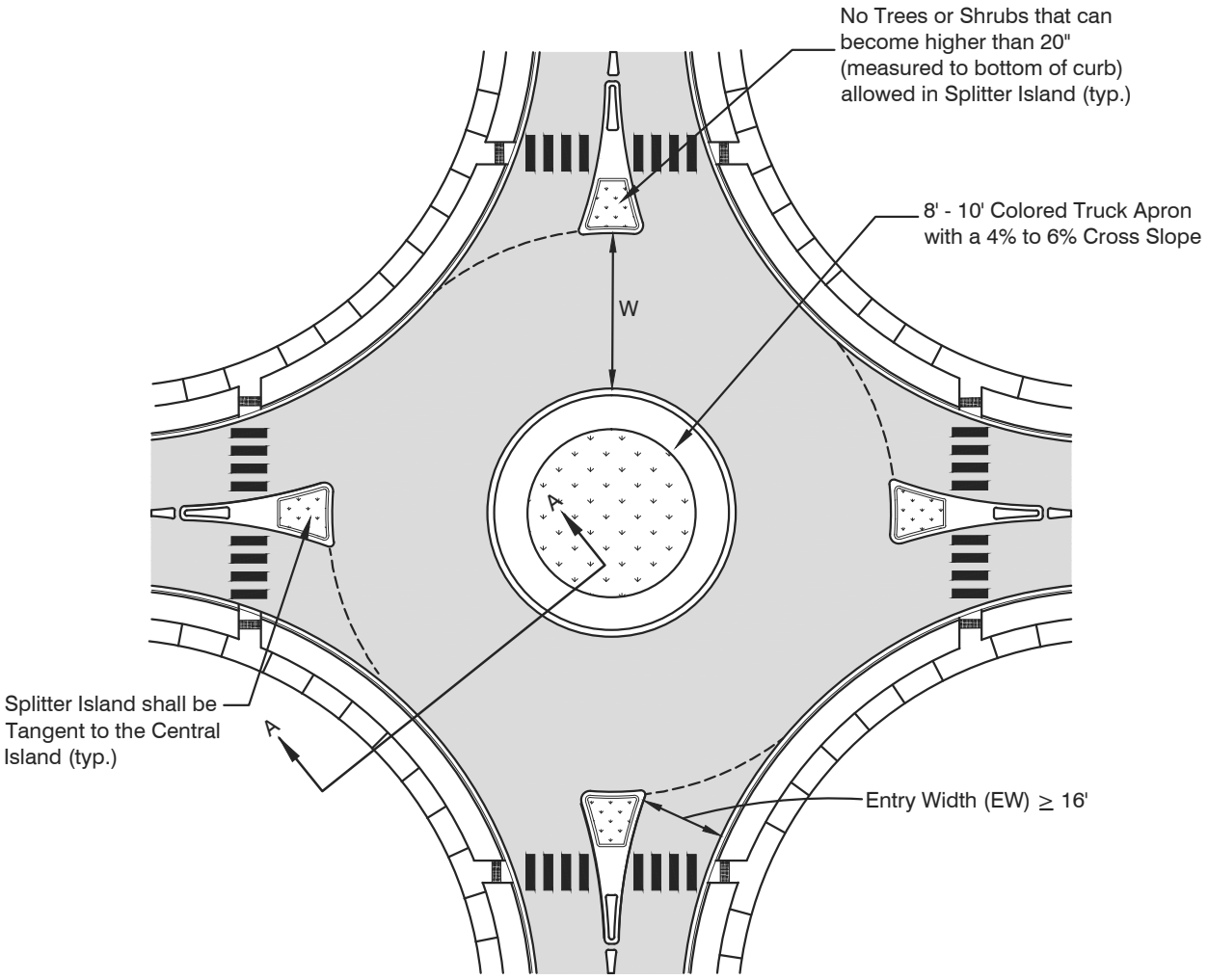
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

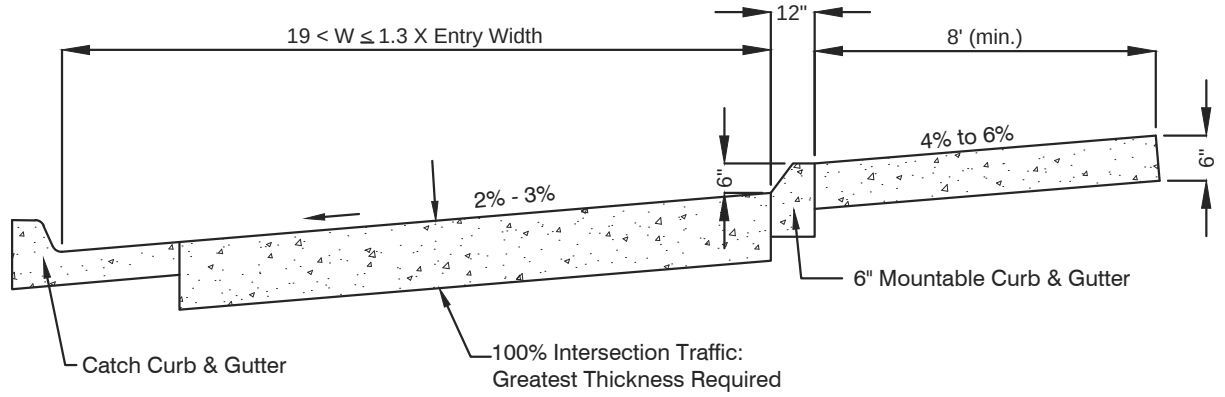
TITLE: ***MINIMUM STREET STANDARDS***

DATE: February 23, 2015

FIGURE: **5-11**

DESCRIPTION: SPLITTER ISLAND FOR ROUNDABOUTS





SECTION A - A

CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: **MINIMUM STREET STANDARDS**	DATE: October 1, 2014	FIGURE: **5-12**
	DESCRIPTION: TYPICAL ROUNDABOUT		

CHAPTER 6 – PAVEMENT STRUCTURE AND MATERIALS

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CHAPTER 6 – PAVEMENT STRUCTURE AND MATERIALS

6.1 GENERAL

The purpose of this chapter is to present the Pavement Design Criteria required for use on streets in the City of Fayetteville. These criteria shall be used in conjunction with **Chapter 4, Street Design and Technical Criteria**. The Final Pavement Design Report shall include all testing in accordance with **Table 6-1**.

6.1.1 Existing Streets

For existing streets the City Engineer may require an evaluation of the existing pavement and base structure to determine if an overlay is feasible, or if reconstruction is necessary.

Any damage done to existing City streets during construction shall be repaired and/or replaced at the contractor's expense. All repair work shall meet the requirements of this document.

6.1.2 AASHTO Design

The design criteria and procedures presented follow **American Association of State Highway and Transportation Officials (AASHTO)** Guide for the Design of Pavement Structures.

6.1.3 Standard Pavement Section

Streets are to be constructed of asphaltic concrete pavement or Portland cement concrete pavement, base course material, and subbase material (where required), and placed on compacted, unyielding subgrade.

The use of treated subgrade, treated base, and/or full depth asphalt pavement may be acceptable when designed and submitted by the designer, and approved by the City Engineer in accordance with these standards.

On streets with grades steeper than 10%, concrete pavement may be required. The final determination will be made by the City Engineer.

The pavement section requirements for alley construction, whether private or public, shall be the same as for a public roadway. Alternative pavement materials proposals will require approval from the City Engineer.

6.1.4 Roundabouts

The pavement thickness design for the circulatory roadway shall be based on the sum of the 20 year design volumes from all legs. A separate design analysis is required. Refer to **Section 5.3** for Roundabout design requirements.

6.1.5 Approval

The pavement design shall be submitted with final construction plans for approval.

6.1.6 Pavement Report Revisions

A revised Pavement Design investigation and report shall be required if the following conditions occur:

A. Phases

If a street is to be built in phases, (i.e., the center two lanes are built first, then at some later date more lanes are added), and it has been at least two years since the original design was completed.

B. Imported Fill Material

If any new fill material that does not match the properties of the subgrade soil proposed in the design is imported, the City may require a new pavement design report or additional testing to verify the acceptability of this material for roadway fill.

C. Change in Existing Conditions

If material that is not consistent with the approved design report is discovered during construction, the City may require a new pavement design report or additional testing to verify the acceptability of this material

6.2 SOIL INVESTIGATION REQUIREMENTS

6.2.1 Location and Frequency of Soil Borings

Soil borings shall be taken in the existing or proposed street right-of-way. Subgrade samples shall be taken upon the material that will be subgrade for the proposed street improvements. Sample sizes shall be adequate for soil classification, compaction, and CBR testing.

A minimum of one boring shall be obtained for any roadway segment. The distance between borings shall not exceed 500 feet. Multiple samples shall be taken alternately

among lanes and shall be evenly spaced. The City Engineer may require more frequent testing.

Samples shall be taken to a minimum depth of 5 feet below the proposed subgrade elevation.

6.2.2 Imported Fill

All fill material placed in the right-of-way shall be tested and approved by the City prior to its use on the project. The material shall meet minimum requirements. Sampling shall be at the beginning of the project, and after every 5,000 cubic yards of material is placed.

6.2.3 Supervision by Engineer

All sampling and testing of soils shall be performed under the direct supervision of a Professional Engineer who must sign and stamp the report.

6.3 SUBGRADE AND FILL REQUIREMENTS

6.3.1 General

To simplify subgrade support testing, soil samples may be combined to form soil groups consistent with the **AASHTO** classification, group index, and location for the area investigated. Groupings shall not mix samples with different **AASHTO** classifications.

Appropriate tests, to include gradation, Atterberg limits, maximum compaction testing, and California Bearing Ratio tests, shall be accomplished in order to determine the suitability of soils for use as subgrade material within the roadway.

"Subgrade" shall be defined as material within 2 feet of the first paving layer (base or asphalt). Roadway limits shall extend to 1 foot behind the back of curb, or edge of pavement when no curb is present.

6.3.2 Classification Testing

Soils shall be classified visually and tested to determine the properties. Soils shall be classified according to the AASHTO Classification system.

6.3.3 Compaction Testing

Maximum density of soils proposed for use as subgrade material shall be determined by AASHTO T-99 (Standard Proctor Test), using Note 7. A new moisture/density test shall

be completed for every 5,000 cubic yards of material imported, or when field testing results indicate a change in material. This includes instances when field testing results yield percentages of compaction relative to maximum of 105% or greater.

6.3.4 California Bearing Ratio (CBR) Testing

CBR testing in accordance with ASTM D 1883-94 shall be completed on all soils proposed for use as subgrade material. CBR testing shall be performed at the dry density corresponding to 95% of the maximum dry density of the material being tested, and at 2% above optimum moisture content.

The 3-point method of CBR testing shall be performed on in-situ soils classified as A-1 or A-2, and on all soils proposed for use as borrow material for subgrade.

6.3.5 Subsurface Water Investigation

If groundwater is encountered or predicted to be encountered within 5 feet of the original or proposed ground surface, a subsurface water investigation report shall be submitted for approval by the City Engineer. This report is required to ensure mitigation of high groundwater effects upon public improvements within the right-of-way. This information may be a separate report or may be included in the geotechnical report.

6.3.6 Subgrade Requirements

The top 24 inches of subgrade must be of material meeting the following specifications unless a formal design is approved:

A. Material classified by the AASHTO Soil Classification System as A-1, A-2, or A-3, having a maximum of 35 percent of the material passing the number 200 sieve, and having a CBR equal to or greater than 8.
B. Material not meeting the above requirements for AASHTO Classification and gradation, but having a CBR equal to or greater than 8 and a Liquid Limit and Plasticity Index of less than or equal to 40 and 15, respectively.
C. Material not meeting the above requirements for Liquid Limit and Plasticity Index may be used if chemically modified by the use of lime, fly ash, or cement. The type and amount of treatment shall be determined by a material testing lab and approved by the City. The chemically modified soil must meet all requirements of Section A above.
D. Material not meeting the CBR requirements of Section A above, but meeting the requirements for Liquid and Plasticity limits may be used provided a formal pavement design based on the actual CBR value of the soil is provided. For this case, CBR values shall be a minimum of 4. Use of lower CBR values may be allowed

where specialized pavement designs using geogrids or other technologies are proposed.

6.3.7 Embankment Outside the Roadway

Material for curb backfill, under sidewalks, on backslopes, or in other areas within the right-of-way may be any material that is free from sod, stumps, roots, or other perishable or deleterious material that it be capable of forming a stable embankment when compacted. Areas outside the roadway shall be compacted to minimum of 90% Standard Proctor density unless otherwise specified.

6.4 PAVEMENT DESIGN CRITERIA

6.4.1 Flexible Pavement

Flexible pavements are those pavements that have sufficiently low bending resistance to maintain continuous contact with the underlying structure, yet have sufficient stability to support a given traffic loading condition. Commonly known as asphaltic concrete pavement.

Refer to **Table 6-1** below for structural number coefficients for the pavement design.

Table 6-1 Pavement Strength Coefficients

Pavement Structure Component Conventional Materials	Design Strength Coefficients (Per Inch of Material)	Limiting Test Criteria
ACHM Surface Course	0.44	*2” Min. Course
ACHM Binder Course	0.44	*3” Min. Course
ACHM Base Course	0.36	R 90+ *4.5” Min. Course
Aggregate Base Course (Class 7)	0.14	R>72 6” Min. Course
Chemically Treated Subgrades (or Approved Substitute)		**Compressive Strength of Field Specimen**
Cement Treated Subgrade	0.23	7 day, 650–1000 psi
Fly Ash Treated Subgrade	0.10	7 day, 150 psi @ 70°±
Lime Treated Subgrade	0.14	7 day, 160 psi, PI <6
Kiln Dust Treated Subgrade	0.10	7 day, 150 psi, PI <6

* Maximum lift is only limited by compaction requirements.

6.4.2 Rigid Pavement

A. General

Rigid pavements are those that possess a high bending resistance and distribute loads over a large area of foundation soil. Commonly known as Portland Cement Concrete Pavement.

B. Joint Design

The construction plans for rigid pavement areas shall include a joint pattern layout for each street, alley and intersection. All joints and joint filling in rigid pavement shall be designed and detailed in accordance with the current AASHTO standards.

6.4.3 Design Factors

A. Equivalent Single Axle Loads (ESAL)

Equivalent Single Axle Loads (ESAL) units are based on 18 kip (80 kN) axle loading on each design lane. All data and design procedures in this section use ESAL units for pavement loading repetitions. Maximum ESAL criteria for local residential and collector streets are given in **Table 6-2**. Where existing or projected traffic is such that maximum ESAL's are exceeded, a formal design will be required, at the discretion of the City Engineer. ESAL calculations are required for arterial streets.

Directional distribution of ESAL's may be 50% unless the Traffic Study indicates otherwise. Lane distribution factors shall be 80% for two lanes of travel in each direction.

In the absence of truck traffic distribution data, 5% trucks shall be used, distributed across truck types in accordance with Federal Highway Administration guidance for urban arterial streets. The City Engineer may require a higher percentage of trucks to be included in the calculations when existing or projected truck traffic is expected to exceed 5%.

B. Design Serviceability

The Serviceability Index to be used for all City Roadways dedicated for public use is given in **Table 6-2**.

C. Minimum Pavement Section

Table 6-2 provides the minimum acceptable pavement sections and Structural Numbers for each roadway classification based on a minimum CBR of the subgrade material of 8, and on the maximum number of ESAL's as specified. For lower CBR values and higher ESAL's, pavement design calculations shall be provided. In

specifying layer thickness, the designer shall consider how the pavement section will be physically constructed, including minimum asphalt layer thicknesses.

D. Portland Cement Concrete Working Stress (f_t)

The working stress (f_t) to be used in the design shall be 75 percent of that provided by third-point beam loading, which shall have a minimum laboratory 28-day strength of 600 psi based on actual tests of materials to be used.

E. Arterial and Collector Level Intersections

The pavement thickness design for arterial and collector level intersections shall be the combined 20-year design for both directions for the shared use areas. A separate design analysis is required.

Table 6-2 Pavement Design Criteria

ROAD CLASSIFICATION	20-Year Design Traffic Information	Serviceability Index (PSI)			Reliability	Minimum Asphalt for Composite Section	Default Aggregate Base Course Section	Default Full Depth Asphalt Pavement Thickness inches	Minimum Concrete for Rigid Section	Min. Struct. No.
	MAXIMUM ESAL'S	p_o Init.	p_t Final	Δ PSI Diff.	(%)	Layer, inches HMA	Layer, inches ABC	Layer, inches Min.	Layer, inches Min.	
LOCAL	50,000	4.5	2.0	2.5	80	3.0	8.0	5.5	6.0	2.42
COLLECTOR *	500,000	4.5	2.0	2.5	85	5.0	6	7	Design	3.04
ARTERIAL										
Two lane	Design	4.5	2.5	2.0	95	Design	Design	Design	Design	Design
Four lane	Design	4.5	2.5	2.0	95	Design	Design	Design	Design	Design

***** A pavement design may be required as requested by the City Engineer.

6.4.4 Pavement Materials

A. Aggregate Base Material

Materials for aggregate base courses shall meet the requirements of Section 303.02 of the AHTD Standard Specifications Edition of 2014.

B. Asphalt Concrete Hot Mix

Materials for Asphalt Concrete Hot Mix base, binder, and surface courses shall meet the requirements of the 2014 AHTD Standard Specifications referenced in the

following. NO MARSHALL MIXES ARE ALLOWED UNLESS SPECIFICALLY AUTHORIZED IN WRITING BY THE CITY ENGINEER.

Asphalt mix designs shall meet the requirements of Section 404.01(b), and Tables 405-1, 406-1, 407-1, and 407-2 of Sections 405, 406, and 407, with additional requirements as follows:

Table 6-3 Asphalt Requirements

20-Year Design Traffic Information	Number of Gyrations (N)			Asphalt Grade	Surface Course Aggregate Size Allowed
ESAL'S	$N_{initial}$	N_{Design}	N_{Max}		N_{mas}
<300k	6	50	115	64-22	9.5
300k-3 Million	7	75	160	70-22	9.5/12.5
>3 Million	8	100	205	76-22	12.5

3/8" (9.5) mm surface course shall be used on all residential and local streets. ½" (12.5 mm) surface course shall be used on arterial streets. Collector streets may use either type of surface mix.

Lift thicknesses shall be a minimum of 3 times the maximum nominal aggregate size. Maximum lift thicknesses will be limited by capability of compaction equipment to achieve minimum compaction requirements, but will not be allowed to exceed 6 times the maximum nominal aggregate size.

C. Concrete Requirements

Materials for Portland Cement Concrete Pavement shall meet the requirements of the latest edition of the AHTD Standard Specifications. Concrete for paving shall be Class B concrete with a minimum 28-day compressive strength of 4,000 psi and shall have air entrainment of 4 to 7 percent.

6.4.5 Special Considerations

A. Staged Construction

This is an alternative for the Developer to provide a minimum thickness pavement during construction, and after repairs, construct the final lift of asphalt, providing for a new finished pavement surface.

(HMA) may be submitted for approval with a minimum wearing course thickness of 2.0 inches. If the full pavement section is not to be placed immediately, a pavement

design for staged construction may be required by the City Engineer. The staged construction design must include asphalt thickness for each proposed stage. Calculations, traffic numbers, and construction truck traffic numbers supporting the staged design must also be submitted. For staged construction, accommodations must be provided for the paved surface to drain with no water left standing on the pavement.

B. Full Depth Sections

Full depth asphalt pavement sections will be considered on a case by case basis where depth of bedrock, drainage, and soil conditions are compatible with full-depth asphalt. When permitted by the City Engineer, full depth asphalt pavements shall consist of one or more layers of black base or binder course topped with one or more layers of surface course.

C. Rehabilitating Existing Asphalt Streets

Prior to overlaying existing asphalt, the City Engineer may accept nondestructive testing to determine the amount of overlay necessary to bring the street to current standards. All "pot-holes," utility trench settlement, cracking, and any similar imperfections shall be repaired to the City Engineer's satisfaction prior to overlaying.

D. Special Requirements

The City Engineer may require full depth asphalt, Portland cement concrete or chemically treated base or subgrade in locations where traffic, utilities, type of construction, subsurface drainage, or time of construction would make asphalt on aggregate base impractical.

6.5 PAVEMENT DESIGN REPORT

The pavement design report shall be prepared by or under the supervision of and signed and stamped by a Professional Engineer registered in the State of Arkansas. The report shall make a recommendation for a typical pavement structural section based on known site soil conditions and a valid traffic impact study, when required. The report shall be submitted in pdf format.

6.5.1 Required Information for Pavement Design Report

A. List of Required Information

1. Project Name.
2. Owner Name and Contact Information.

3. Vicinity map to locate the investigated area.
4. Scaled drawings showing the location of final borings.
5. Plat with street names.
6. Scaled drawings showing the estimated extent of subgrade soil types and ESAL for each street classification.
7. Pavement design alternatives for each street classification.
8. Tabular listing of sample designation, sample depth, Group Number, liquid limit, plasticity index, percent passing the No. 200 sieve, **AASHTO** Classification, Group Index and soil description.
9. Swell/consolidation tests.
10. Borrow source identification.
11. Design calculations for all phases of soil report.
12. Design coefficient used for asphalt, base course, etc. Refer to **Table 6-1**.
13. Mix design test results as discussed in **Chapter 11, Street Inspection and Testing Procedures**, where chemical stabilization has been approved.
14. A discussion of potential subgrade soil problems including, but not limited to:
    a. Heave or settlement prone soils.
    b. Frost susceptible soils.
    c. Ground water.
    d. Drainage considerations (surface and subsurface).
    e. Cold weather construction (if appropriate).
    f. Soluble sulfates in subgrade.
    g. Other factors or properties that could affect the design or performance of the pavement system.
15. Recommendations to alleviate or mitigate the impact of problems discussed in Item 14 above.
16. Professional Engineer Stamp

CHAPTER 7 – TRAFFIC CONTROL DEVICES

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CHAPTER 7 – TRAFFIC CONTROL DEVICES

7.1 GENERAL

This chapter describes general signal, signing, and striping design requirements for use in the City of Fayetteville. All design and construction of signals, signing, and striping shall be in conformance with this chapter and the latest revision of the **MUTCD**. The traffic signal and signage plans shall be included in the construction plan submittal.

7.1.1 Installation Responsibility

The cost of the installation of traffic signals, street signage and pavement markings is the responsibility of the developer when required with a proposed development. The work and materials necessary for the installation shall be included as part of the street improvements.

7.2 DESIGN REQUIREMENTS

7.2.1 Traffic Signal Design Requirements

The design of traffic signals shall be performed by a qualified Traffic Engineer approved by the City. The design will follow the latest edition of "Standard Specifications for Highway Construction," published by **AHTD.**

A. Design Requirements

1. All mast arm/signal poles, luminaire arms, extensions, foundations, pull boxes and conduit shall meet AHTD Standards and details.
2. Street light luminaire shall be LED or a 250 Watt HPS streetlight fixture with cut off design.
3. Controller and cabinet shall be Peek equipment.
4. Radio shall be Ip addressable or compatible with closed loop system.
5. Tomar fire preemption system complete with detectors, wiring, and card in the cabinet is required.
6. Attachment height for mast arms to signal pole shall be at 20 feet.
7. Video detection with wiring and detector cards for detection counting traffic on all approach lanes shall be used per Traffic Superintendent approval.
8. Black, 12"-12"-12" polycarbonate signal head tunnel visors with 5" black back plates shall be mounted using astrobrackets over the center of each lane. Side of pole mounted 12"-12"-12" are for the far side right, which

will cover any dedicated right turn lanes. Use of far side left 12”-12”-12” or 12”-12”-12”-12” heads with tunnel visors are determined on an intersection by intersection basis but will be used in most cases on State Highways or Arterials with significant large truck traffic. Section heads shall not be doghouse style.

9. Black 16-inch LED pedestrian heads (hand/man) countdown with visors and a clamshell/banding mounting system are required with ADA pedestrian buttons for all standard pedestrian movements. Crate style protection shall be provided for all pedestrian heads.
10. Two 3-inch conduits (Schedule 40 PVC minimum) will be used for wiring between the signal bases and the cabinet.
11. Pedestrian buttons shall be the Pelro SE-2000-08-P33 type with audio alert, LED light, and sign housing/back plate.
12. The City of Fayetteville operates its own communications network for the traffic management system, and as such, any new traffic signal installation shall include the design and expansion of that communications network from an approved existing access point to the new signal. The design and expansion of the communications network shall be per the traffic operations specifications current at that time.

7.3 TRAFFIC SIGNING

7.3.1 General

A. Type and Location of Signs

The Traffic Superintendent shall make the final determination regarding the type and location of signage controls within the city right-of-way. These controls shall include traffic control signs, street name signs, delineators, and permanent barricades. AHTD requirements shall apply for all signage within AHTD right-of-way.

B. Design, Installation, and Maintenance

Because the City will maintain the permanent traffic control devices on public rights-of-way, all traffic control devices shall be fabricated and installed in accordance with this chapter and the latest revision of the **MUTCD**.

C. New Roadway

Permanent signage, unless otherwise approved by the Traffic Superintendent, shall be completely in place before any new roadway is opened to the public.

D. Other Standards

These Standards are to be used in conjunction with other applicable City Regulations.

E. Sign Posts, Supports, and Mountings

1. Sign Post. The post shall be 12' 2#/ft green U-channel post. If the sign area is greater than 6 sf, then the post must be 3#/ft.
2. Sign Bolts. Signs shall be mounted to the post with a minimum of two 5/16" hex bolts with metal washers and nylon washer (against sign face) at the top of sign.

F. Sign Reflectivity

All traffic control signs must be fabricated with reflective materials. All reflective materials to be a minimum of high intensity material or greater per **ASTM TYPE III**. All signs or traffic control devices must have a 7-year materials warranty.

G. Backing Plates

Aluminum blanks of .080 gauge are standard, except for signs larger than 36 x 36 inches, which shall be .100 or .125 gauge aluminum.

7.3.2 Intersections

A. Street Name Sign

1. General. All street name signs must conform to these standards. If the intersection has a traffic signal, street name signs will be designated as part of the signal.
2. Minor Intersection. Nine-inch plates shall be used at all minor intersections; lengths will vary to fit street names.
3. Major Intersection. Nine-inch plates shall be used at all major intersections, which include the intersections with Collector and Arterial Roadways.
4. Sign Assembly. There shall be one plate for each road, with a minimum of two plates per street sign assembly. Typical installation shall include two street name signs, one for each direction. For signs with lengths of 18" – 30" use .125 gage blank thickness; for signs 36" – 48" us .125 gage blank thickness.
5. Sign Face.
   a. Letter Size - 6"; Height of Sign Blank – 9".
   b. Color. Letters and numbers are to be white on a green background face. The colors shall not fade when exposed to an accelerated test of

ultraviolet light equivalent to 5 years of outdoor exposure. No silk screened signs are permitted.

c. Border. There shall be a .625" white border on post mounted street name signs.
d. The street names shall be a combination of upper and lower case with the suffix (St., Ave., Ln….) being in 3.5" upper and lower case.

6. Street Name. Street names designations should be obtained from the approved plat.

B. Stop Signs

1. Location of all stop signs shall be determined and discussed in the TIS, when required.
2. Stop signs will be placed in accordance with the TIS, approved construction plans, and the **MUTCD**. Stop signs shall be placed at point of curvature (PC) behind attached sidewalk and before the access ramp.

7.3.3 Traffic Control Signs

A. Design and Size

Sign specifications and diagrams are detailed in the latest revision of the Federal "Standard Highway Signs," latest version. This publication is available from the U.S. Department of Transportation, Federal Highway Administration. Acceptable sign sizes are listed in the standard column of the table printed with each diagram. Expressway and construction signs shall be a minimum 36 inches.

B. Regulatory

1. Reflectivity. All regulatory signs, except parking, shall be **ASTM TYPE III** grade reflectivity or greater. This includes the red series and black on white signs.
2. Sheeting Material. All signs shall be fabricated with sheeting material, including letters.
3. Stop Sign. Stop signs shall be a minimum of 30 inches and **ASTM TYPE III** sheeting or greater.
4. Yield Sign. For minor intersections only, a 36"x36"x36" yield sign may be used in lieu of a stop sign, at the discretion of the City according to **MUTCD**.
5. Parking/No Parking Sign. Designated parking and "no parking" zones shall be signed in accordance with **MUTCD**. No silk screened signs are permitted.

C. Warning

1. Reflectivity Requirements. All pedestrian crossing, school crossing, and W16-7P signs shall be made with diamond grade fluorescent yellow/green sheeting.
2. "Future Street Extension" Sign and Barricades.
   Dead End. All dead-end streets shall have a Type III barricade with appropriate advance warning sign(s)**.** Type III Barricades shall have a "Future Road Extension" sign mounted on the barricade. See **Figure 7-8**.
4. Crosswalk Sign. Crosswalks shall be signed where adjacent to a school and on an established school pedestrian route per Traffic Superintendent approval. There are usually a minimum of 4 signs per crosswalk. The color and installation shall be completed according to **MUTCD**. The color shall be fluorescent yellow green. The diamond shaped sign shall have a minimum height and width of 36 inches.

7.3.4 Roundabouts

Signage in advance of the circulating roadway shall be required. Use "Yield At Roundabout" (W3-2a, 30 x 30 inches; R1-2, 36 x 36 inches), "Roundabout Advisory Sign" (RB-1, 24 x 24 inches) and "Reduced Speed Ahead" (R2-5a,24" x 30") signs. The "Yield" sign (R1-2, 36 x 36 inches) shall be located at each entry to the circulatory roadway. An "arrow" sign, designating direction of travel in circulatory roadway, shall be located within the central island. Refer to **MUTCD.** Specifications for traffic control signs, listed in **MUTCD** , shall apply to these signs.

7.3.5 Temporary Construction Signage

All temporary construction signage shall be placed according to **MUTCD** standards. All temporary signage is subject to review and approval by the City. Temporary street lane closures shall be coordinated with the City, emergency services and transportation providers. Detour plans shall be submitted for review when detours are required.

7.4 PAVEMENT MARKING AND STRIPING

7.4.1 General

A. Type and Location of Striping and Markings

Per **MUTCD** Section 3 B.01: Centerline markings shall be placed on arterials and collectors 20 feet or more in width and having an ADT of 6000 vpd or greater.

The Traffic Superintendent shall make the final determination in regards to the type and location of pavement striping and marking within the right-of-way during the review of the project signing and striping plans.

B. Design, Installation, and Maintenance

The City maintains the permanent pavement striping and marking on public rights-of-way after completion of the warranty period. All such devices shall be specified and installed in accordance with these Standards; all designs shall be in accordance with these Standards and the latest revision of the **MUTCD**.

C. New Roadway

Permanent striping and marking, unless otherwise approved by the City Engineer, shall be completely in place before any new Roadway is opened to the public.

7.4.2 Pavement Markings (Symbols and Arrows)

A. General

Preformed thermoplastic shall be used on all pavement markings such as arrows, “onlys,” crosswalks, railroad crossings, school crossings, stopbars, and bike symbols.

B. Preformed Thermoplastic Pavement Marking Specifications

The prefabricated markings described shall be 125 mils in thickness unless otherwise specified and consist of white or yellow pigmented plastic film with imbedded reflective glass spheres, uniformly distributed throughout their entire cross-sectional area. It shall be possible to affix the markings to bituminous or Portland cement concrete pavements by either a pressure sensitive precoated adhesive or a liquid contact cement and shall have a black contrasting border 4” wide. Prefabricated legends and symbols shall conform to the applicable shapes and sizes as outlined in the **MUTCD**.

C. Crosswalks

1. General. Crosswalks shall be used at all signalized intersections, approved crossings, school routes, adjacent to schools, and as otherwise directed.
2. Standard Crosswalk. White 10-feet long x 12-inch wide bars with 48" spacing shall be used for all crosswalks.

D. Stop Bars

All stop bars shall be white and a minimum of 12 inches wide. Stop bars are required at signalized locations where the speed limit is 35 mph or higher and other locations specified by the City Engineer.

E. Symbols

Preformed thermoplastic pavement marking standard material shall be a minimum of 125 mils thick unless otherwise approved. This material shall be used for all arrows, "only," bike symbols, bike diamonds, sharrows, railroad crossing symbols, etc.

F. Roundabouts

1. Yield Line. The roundabout shall require a yield line at the point of entry into the circulatory roadway unless otherwise approved by the City Engineer.
2. Crosswalk. Generally, crosswalks do not need special markings on each approach leg at a roundabout.
3. Lane use arrows shall be fish-hook type with circle.

7.4.3 Striping

A. General

1. Typical striping widths for lane lines are 4 inches, unless otherwise noted. Double yellow centerline must have a 4-inch minimum gap between stripes.
2. Preformed thermoplastic shall be used on all striping. Thermoplastic as specified in 7.4.2 shall be used.
3. All striping on sealcoats shall require a layout line. Prior to striping, tabs are required for sealcoats (prior to the sealcoat process). All other conditions require spot taping at an interval of 25 ft or closer.

B. Broken Line

All broken lines shall be 4-inch wide using a 40 foot cycle (10' long with 30' gap).

C. Dotted Line

All dotted lines shall be 4-inch wide using a 6 foot cycle (2' long with 4' gap).

D. Turn Bay Line

All turn bay lines shall be created with a minimum 4-inch wide line. However, if a turn bay occurs on a horizontal curve, the bay taper from the start of the double wide 4" may be marked with short 4-inch wide dotted lines (2' long with 4' gap).

E. Centerline

All centerline striping shall be double yellow, each a minimum of 4 inches wide, with an 8-inch minimum gap between the two.

F. Parking Stalls and Angle Parking

All striping for parking shall be white and 4 inches wide. All edge lines of parking areas shall also be white and a minimum of 4 inches wide.

G. Bikeway

A 4-inch minimum wide white stripe shall be used for Bike Lanes.

7.4.4 Temporary Striping

All temporary striping shall conform to "Standard Specifications for Highway Construction," published by **AHTD**, the latest revision except as herein amended. When approved, temporary striping shall be required prior to the opening of a Roadway for travel where pavement and/or permanent striping cannot be completed due to weather and/or time constraints or for staged construction.

A. Specifications

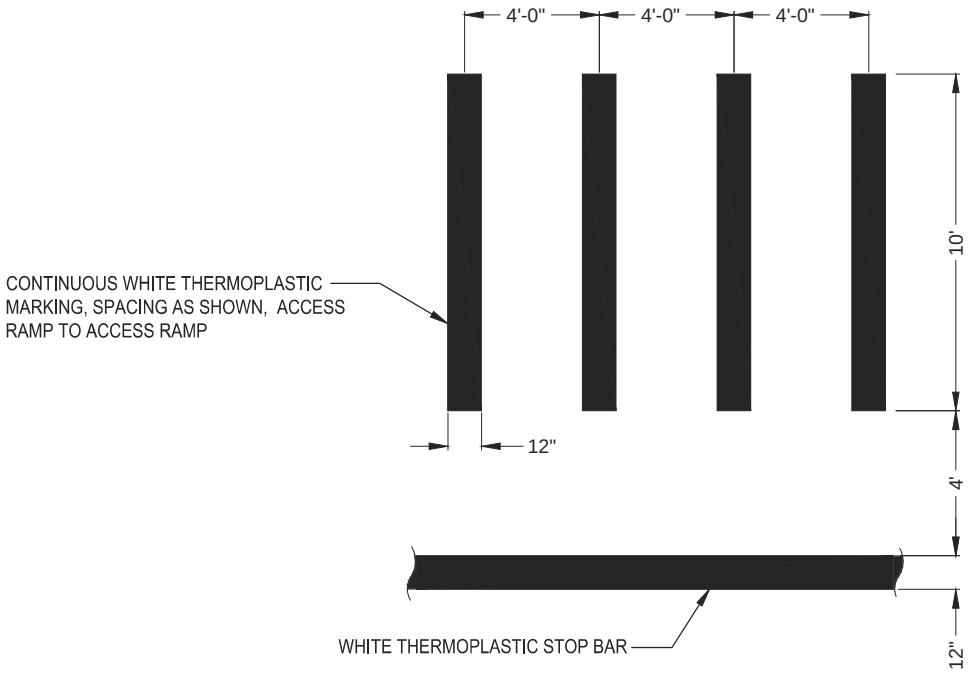
Temporary striping shall be the same color and width as for permanent striping. Temporary striping shall consist of tabs, 4 x 4-inch (min.) tape, or paint depending on the pavement surface, spaced at 25-foot intervals.

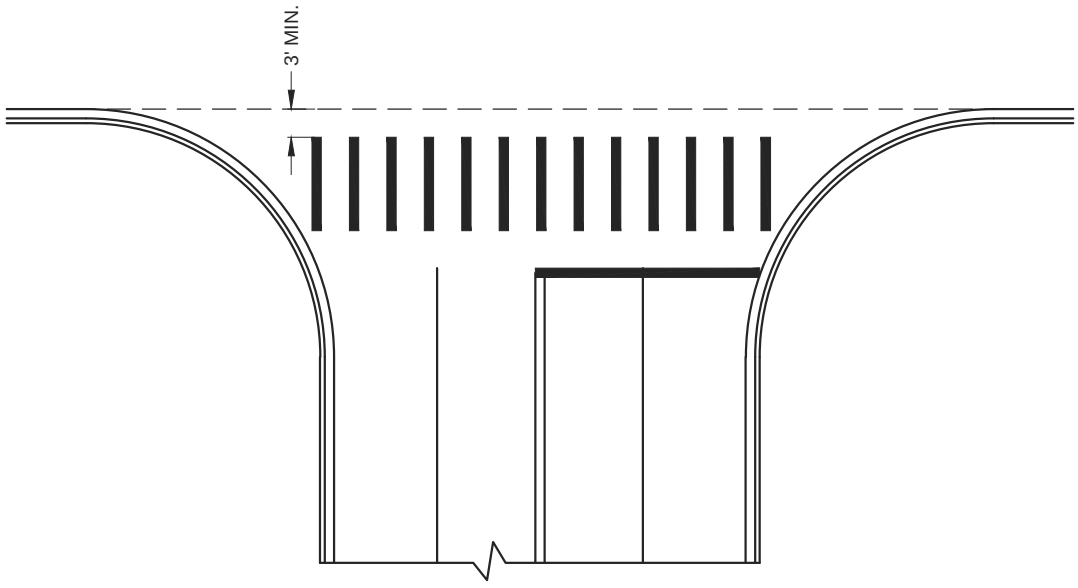
B. Time Duration Limit

Temporary striping is permitted for no more than 7 days unless for staged construction or otherwise approved.

C. Extensions

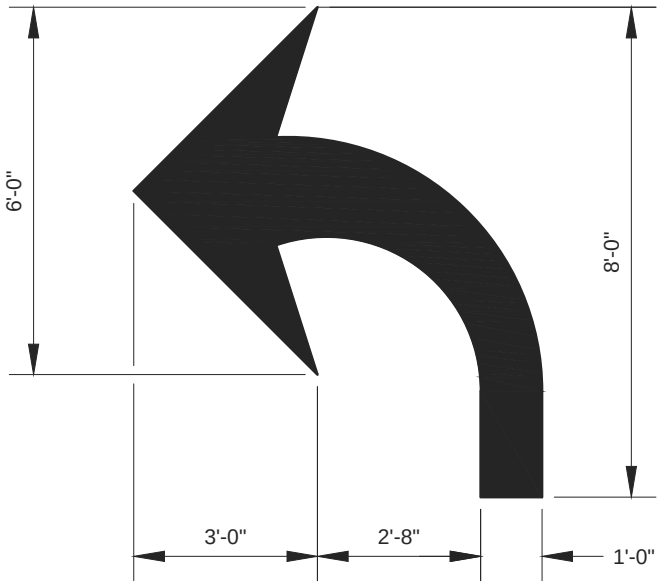
Extensions must be requested in writing if weather does not allow installation of permanent striping.





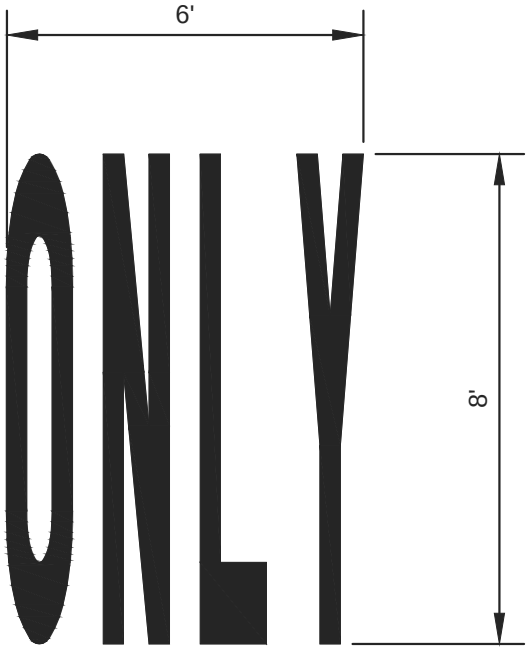
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE:	DATE:	FIGURE:
MINIMUM STREET STANDARDS	February 23, 2015	**7-1**
DESCRIPTION: CROSSWALK AND STOPBAR		



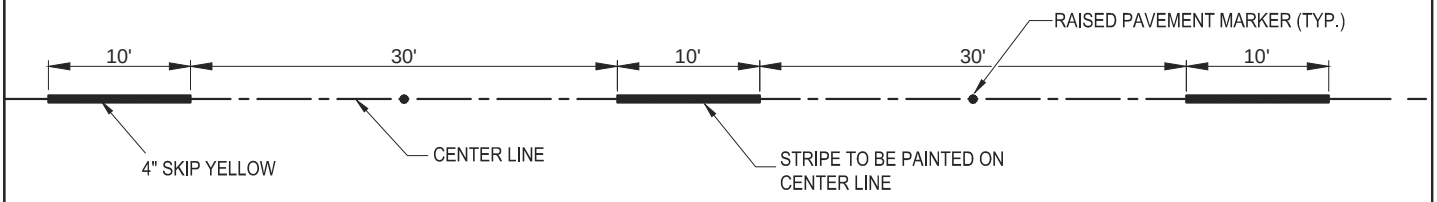
NOTE: ALL PAVEMENT MARKINGS TO BE
THERMOPLASTIC MATERIAL

CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: ***MINIMUM STREET STANDARDS***	DATE: October 7, 2014	FIGURE: **7-2**
	DESCRIPTION: TURN ARROW MARKING		

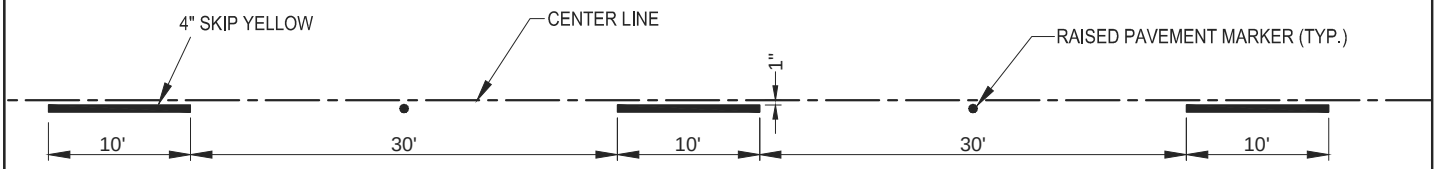


CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE:	DATE:	FIGURE:
MINIMUM STREET STANDARDS	October 7, 2014	**7-3**
DESCRIPTION: "ONLY" MARKING		

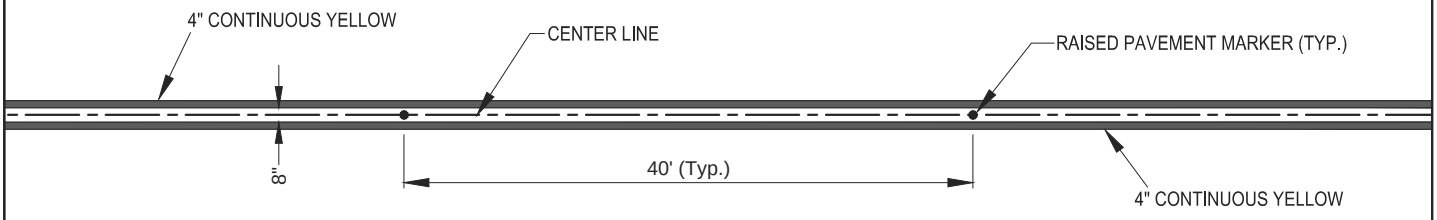


ASPHALT PAVEMENT



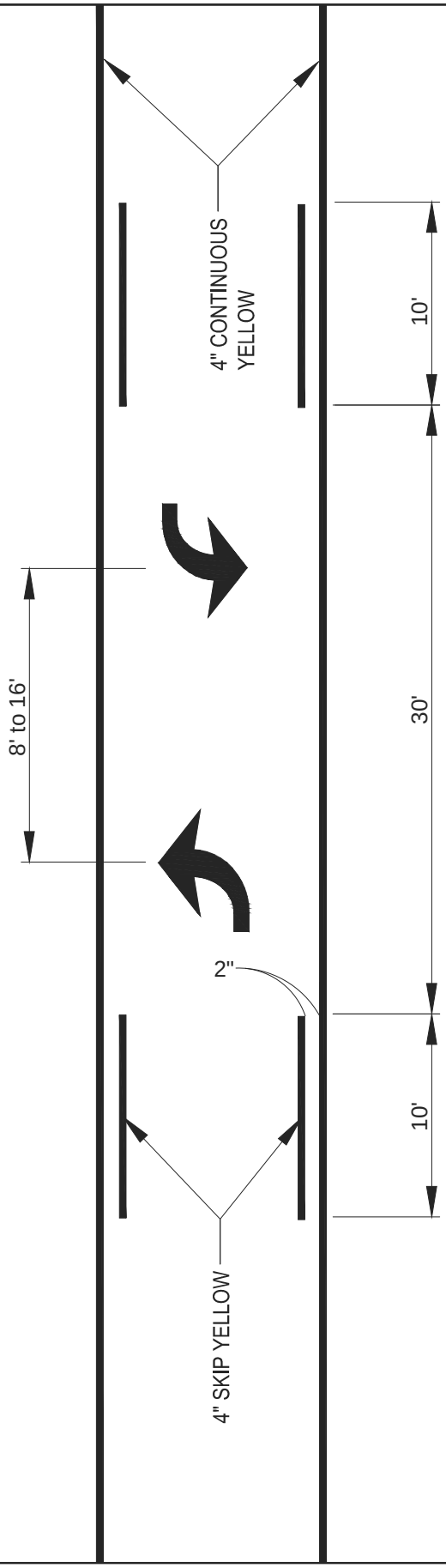
CONCRETE PAVEMENT

CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: ***MINIMUM STREET STANDARDS***	DATE: February 23, 2015	FIGURE: **7-4**
	DESCRIPTION: BROKEN LINE STRIPING		



CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE:	DATE:	FIGURE:
MINIMUM STREET STANDARDS	February 23, 2015	**7-5**
DESCRIPTION: SOLID LINE STRIPING		



NOTE:
THE PAIRS OF ARROWS SHOULD BE INSTALLED A MAX. OF 500' APART

CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE: ***MINIMUM STREET STANDARDS***

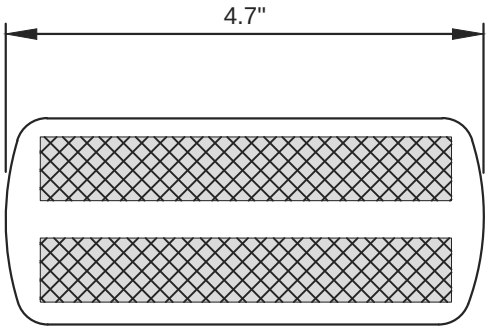
DATE: February 23, 2015

FIGURE: **7-6**

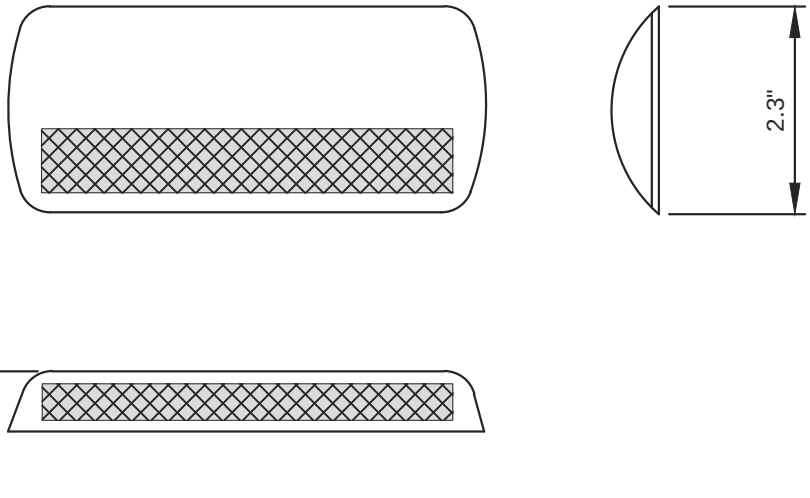
DESCRIPTION:

CENTER TURN LANE STRIPING

TYPE II
RED/CLEAR OR
YELLOW/YELLOW

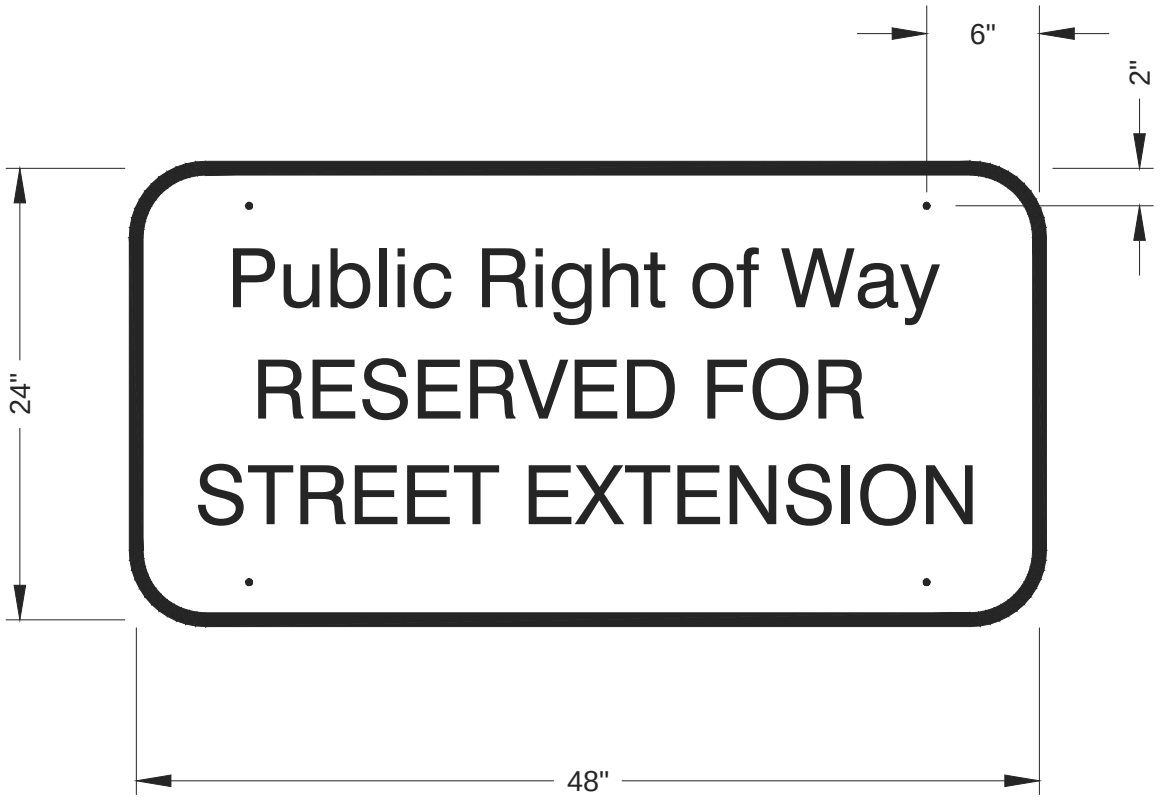


TYPE I
CLEAR OR
YELLOW



NOTE:
THE RED LENS OF THE TYPE II
R.P.M. SHALL FACE THE INCORRECT
TRAFFIC MOVEMENT

CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: ***MINIMUM STREET STANDARDS***	DATE: October 7, 2014	FIGURE: **7-7**
	DESCRIPTION: RAISED PAVEMENT MARKERS		



1. SIGN SHALL HAVE ASTM TYPE III GRADE REFLECTIVITY.
2. SIGN SHALL BE WHITE WITH BLACK LETTERING.
3. INCLUDE FOUR 3/8" DIAMETER HOLES FOR MOUNTING.
4. SIGN SHALL BE MOUNTED ON A TYPE III BARRICADE.

CHAPTER 8 – PEDESTRIAN FACILITIES DESIGN AND TECHNICAL CRITERIA

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LIST OF FIGURES

This Chapter Does Not Contain Figures

CHAPTER 8 – PEDESTRIAN FACILITIES DESIGN AND TECHNICAL CRITERIA

8.1 GENERAL

This chapter sets forth the minimum criteria to be used in the design of all sidewalks, access ramps, and other pedestrian facilities within the right-of-way, or other public easements.

8.1.1 Reference Documents

Within this chapter, AASHTO's A Policy on Geometric Design of Highways and Streets, as published by the American Association of State Highway and Transportation Officials, and the ITE Designing Walkable Urban Thoroughfares were used as a reference.

8.1.2 ADA Requirements

All pedestrian facilities shall be designed in accordance with American Disabilities Act (ADA) regulations and the requirements of these Standards. Any variances from these requirements shall be in accordance with ADA requirements and shall be approved by the City Engineer prior to construction.

8.1.3 Obstructions

Manholes, utility poles or other appurtenances or obstructions, should not be located in sidewalks or trails unless specifically approved by the City Engineer. A minimum ADA accessible path of 3 feet in width should be provided that is free of such obstruction when feasible.

8.1.4 Sidewalk Underdrains (Chases)

Sidewalk underdrains shall not interfere with the pedestrian's use of the sidewalk. Underdrains shall not be located within an access ramp, curb cut, or driveway.

8.1.5 Pedestrian Crossings

All crosswalks shall be marked in accordance with **Chapter 7, Traffic Control Devices.** Crosswalks will be required at all signalized intersections, school areas, and high pedestrian areas as designated by the City Engineer.

8.1.6 Pedestrian Refuge Areas

For Arterials with raised medians and on splitter islands for roundabouts, a pedestrian refuge area shall be created in the median to increase pedestrian safety. See **Figure 5-8 and Figure 5- 9**.

8.1.7 Safety Railing (Handrails)

Safety railings will be required on any drop adjacent to a sidewalk/trail greater than 30" that has a slope of 1:1 or greater.

8.2 SIDEWALKS

8.2.1 General Layout and Design Criteria

A. Width

Minimum sidewalk widths for the various street classifications shall be as specified in the City of Fayetteville Master Street Plan. The City Engineer may require additional width for activity areas and routes leading to and from these areas. The final sidewalk width shall be determined through additional study of higher pedestrian traffic areas.

When a sidewalk is located adjacent to the back of curb where on street parking is allowed, the sidewalk shall be widened by 1.5' to accommodate the car doors opening onto the sidewalk area.

B. Shy Distance

A shy distance of 2 feet is required where vertical barriers (walls, fences, signs, etc) greater than 3.5 feet in height are adjacent to the sidewalk and extend more than 4 feet in length parallel to the sidewalk. A shy distance of 1.5' is required from the back of curb. A shy distance of 1 foot is required for all other fixed obstacles. Shy distances shall be added to the minimum widths of sidewalks specified in the Master Street Plan or required by the City Engineer to determine the final sidewalk width.

C. Minimum Distance to Slope

There shall be a minimum of 1 foot between the sidewalk and the beginning of a slope.

D. Concrete Requirements

All sidewalks, access ramps and driveway approaches shall be constructed of a Portland Cement concrete mixture that includes at least 5.5 bags of cement per cubic yard and contains 4 to 7 percent air entrainment and that will produce a concrete of a compressive strength of 3,500 psi after 28 days set under standard laboratory methods.

E. Concrete Thickness

All sidewalks not within driveways shall be a minimum of 4 inches thick concrete. All sidewalks within a driveway shall be a minimum of 6 inches thick.

F. Sidewalk Crossings of Driveways and Alleys

Sidewalks shall be continuous through driveways and alleys. Sidewalks shall have an expansion joint at the edge of sidewalk opposite the street. The sidewalk edge adjacent to the street shall have at least 1 inch deep grooved joint mark (cannot be a saw cut) to clearly define the sidewalk through the driveway or alley.

G. Sidewalk Elevation

The back of sidewalk elevation shall be such that the slope from the back of sidewalk to the top of curb is 2% unless otherwise approved by the City Engineer.

H. Slope

1. *Cross Slope.* Sidewalk cross slopes shall be a minimum of 1 percent and a maximum of 2%. The cross slope shall be towards the street unless otherwise approved.
2. *Longitudinal Slope.* Longitudinal slope of sidewalks shall be consistent with the adjacent street slopes.
3. *ADA Requirements for Steeper Slopes*. Sidewalks with greater than 5 percent longitudinal slope or those not adjacent to a street, shall be constructed to meet ADA requirements by use of ramps and landings, construction of switchbacks, or other acceptable means.

I. Joints

1. *Material*. Expansion joint material shall be asphalt impregnated fiberboard meeting the requirements of AASHTO M213, or other joint material meeting the requirements of the latest edition of the AHTD standard specifications.

2. *Location.* Full depth expansion joints shall be provided where sidewalks abut drainage structures, retaining walls, building faces, and all other fixed objects. Expansion joint material shall be provided at each cold joint. One-quarter depth (1 inch) weakened plane joints, or saw-cut joints shall be placed in sidewalks at regular intervals not greater than the width of the sidewalk.
3. *Saw Joints.* Saw joints shall be filled with self-leveling sealant such as Sonneborn SL1 or equivalent meeting the requirements of ASTM C 920, Type S.
4. *Joint Sealant.* All expansion joints and saw joints shall be sealed with joint sealant meeting the requirements of ASTM C 920, Type S. A self-leveling sealant shall be used for horizontal surfaces. A non-sag sealant shall be used for vertical or nearly vertical surfaces.

J. Finish

All sidewalks shall have a broom finish.

K. Curing Compound

All sidewalks require the application of a concrete curing compound or the concrete is to be kept moist for seven (7) days.

L. Existing Sidewalks

When redevelopment is proposed on properties with existing sidewalks, the plans shall show the location of all existing and proposed sidewalk improvements. In accordance with Chapter 166.04 of the UDC, each development will be subject to review of the overall impact to the sidewalks to evaluate the extent of the sidewalk replacement.

Widening of the existing sidewalks to meet current sidewalk width standards is not allowed.

Removal and replacement of the existing sidewalks is required for all:

a. Segments of the sidewalk, including ramps, that do not meet all applicable ADA standards, including cross slope and running slope.
b. Segments that have cracked and/or settled to the extent that they are out of ADA compliance. This is defined as more than ¼ inch of vertical displacement or cracks or joints more than ½ inch wide.
c. Segments that display surface spalling or other distress such that a trip hazard (more than ¼ inch vertical displacement) is created.

d. Segments of sidewalk damaged during construction to the extent that any of the items above apply.

M. Storm Water Runoff at Curb Cuts

Drainage shall meet the requirements specified in **Chapter 4**, in the section/subsection titled **Drainage Systems/Sidewalk Culvert (Chases)**.

8.3 ACCESS RAMPS

8.3.1 Ramp Requirements

Access ramps shall be installed at all sides of all intersections and at certain mid-block locations for all new construction or reconstruction of curb and sidewalk. Access ramps shall meet ADA requirements to the maximum extent feasible.

A. Locations

Intersections. Two access ramps shall be included at all intersection corners. On T-intersections, corresponding access ramp are required opposite the intersecting street. Access ramps shall not be placed in designated parking areas nor in or across from driveways. Ramps shall be located to avoid conflicts with the storm drain inlet depressions.

B. Width

The minimum width of an access ramp shall be 48 inches excluding the flared sides.

C. Slope

The slope of the ramp shall not be greater than 8.33% (1:12) for all new developments.

In existing developed rights-of-way, it may be necessary to install a steeper ramp to provide access to street crossings. In an alteration, slopes as steep as 1:10 (10%) are permitted for the distance of a 6-inch rise if it is not technically feasible to provide a ramp at 1:12 (8.33%). For a 3-inch rise, the maximum slope may be as steep as 1:8 (12.5%) where necessary.

D. Flared Sides

The slope of the flared sides shall not be greater than 10% (1:10).

E. Finish

Access ramps shall have a broom finish.

F. Curing Compound

All access ramps require the application of a concrete curing compound or the concrete is to be kept moist for seven (7) days.

G. Detectable Warnings

Detectable warning devices (truncated domes) meeting ADA requirements shall be installed on all access ramps.

8.4 MULTI-USE TRAILS

8.4.1 General Layout and Design Criteria

A. Width

The minimum width of trails shall be 12 feet and shall follow the trail cross-section guidelines of the Master Transportation Plan.

B. Materials

Selection of trail surface materials depends upon site conditions. Final determination of trail construction materials shall be made by the Trail Coordinator.

1. *Concrete.* Trails shall be constructed of concrete when located in or near floodprone areas, vehicular road crossings, access ramps and within street right of way.

2. *Asphalt.* Trails may be constructed of asphalt in areas where the trail is located above floodprone areas and away from vehicular traffic and street right of way.

C. Grades

All trails shall be constructed with a 2% maximum cross slope in the same direction as the existing grade unless otherwise designated to allow drainage to sheet flow across the trail. Trails adjacent to streets shall have 2% maximum cross slope towards the street. Longitudinal grade shall not exceed 5%. Longitudinal grade may be varied by the Trails Coordinator for sites with difficult topography. In such cases, the AASHTO longitudinal grade requirement for bicycles shall apply.

D. Asphalt Trail Requirements (By approval of the Trail Coordinator Only)

Asphalt trails shall be constructed of asphalt concrete hot mix surface course. Type III surface course meeting the requirements of AHTD Specifications. Asphalt trail sections shall be constructed to the following standards:

1. *Surface.* Asphalt trail sections shall have a minimum 3 inch thick surface.

2. *Base Course.* Base course for asphalt trails shall consist of a minimum 6 inch thickness of Class 7 aggregate compacted to 95% M.P.D.

3. *Subgrade.* The top 24 inches of subgrade shall meet the requirements of **Chapter 6**, Section 6.3.5 for street construction. Existing material not meeting these requirements shall be removed and replaced with approved select fill and compacted to 95% Standard Proctor Density (S.P.D.). Specific site conditions may require the additional undercut, placement of stone backfill or other methods in order to create a solid base.

E. Concrete Trail Requirements

All concrete portions of trails shall be constructed of a portland cement concrete mixture with a compressive strength of 3500 p.s.i. and with 4 to 7 percent air entrainment. Concrete trail sections shall be constructed to the following standards:

1. *Surface.* Concrete trail portions shall have a minimum 4 inch thick concrete surface reinforce with fibers or welded wire fabric with a medium broom finish.

2. *Base Course.* Base course for concrete trails shall consist of a 4 inch minimum thickness of class 7 aggregate compacted to 95% M.P.D.

3. *Subgrade.* The top 24 inches of subgrade shall meet the requirements of **Chapter 6**, Section 6.3.5 for street construction. Existing material not meeting these requirements shall be removed and replaced with approved select fill and compacted to 95% Standard Proctor Density (S.P.D.). Specific site conditions may require the additional undercut, placement of stone backfill or other methods in order to create a solid base. This requirement does not apply where trails are constructed within the right of way adjacent to a street.

4. *Expansion joints.* Full depth expansion joints shall be provided where trails abut drainage structures, retaining walls, building faces, and all other fixed objects. Expansion joint material shall be provided at each cold

joint. Expansion joint material shall be asphalt impregnated fiberboard meeting the requirements of AASHTO M213, or other joint material meeting the requirements of the latest edition of the AHTD standard specifications.

5. *Contraction Joints.* One inch depth weakened plane joints, or saw-cut joints, shall be placed in trail at regular intervals matching the trail width, but not greater than 12 feet apart.

6. *Joint Sealant.* All expansion joints and saw joints shall be sealed with joint sealant such as Sonneborn SL! meeting the requirements of ASTM C 920, Type S. A self leveling sealant shall be used for horizontal surfaces. A non-sag sealant shall be used for vertical or nearly vertical surfaces.

F. Trail Shoulders

A two foot shoulder adjacent to the trail shall be graded smooth and should not exceed 2% cross-slope in the same direction as the trail. The Trail Coordinator shall determine the appropriateness and maintenance requirements of plants and grasses adjacent to trails.

G. Tie Back Slopes

The ground beyond the shoulder shall meet the existing grade with a maximum slope of 3:1. A swale may be required on the uphill side of the trail to direct stormwater runoff to a storm sewer system or culvert crossing. These may be required where runoff is concentrated onto the trail.

H. Trail Signage

Trail signage shall comply with the Manual on Uniform Traffic Control Devices, Part 9 – Traffic Controls for Bicycle Facilities.

I. Street Crosswalks

Trails that intersect and cross public streets shall have a red concrete crosswalk with two foot wide white thermoplastic stripes on each side. Where appropriate, this crosswalk may be raised 2.5 inches above pavement surface. The concrete shall be colored with integral color mix (Soloman Dry Pigment 417 Apple Red with 4% loading) or with thermoplastic (Decomark Herringbone Patter, Brick Red).

J. Striping

Striping shall conform to the Manual on Uniform Traffic Control Devices, Part 9 – Traffic Controls for Bicycle Facilities. Additional striping may be required for increased safety.

K. Location Criteria

Multi-use trail locations shall be based on safety, circulation, and access considerations.

L. Overhead Clearance

All multi-use trails shall have a minimum of 10 feet clear vertical distance above the path.

M. Drainage Design

All culvert crossings shall be designed to carry the 10-year storm event.

8.4.2 Design Speed

For paved surfaces a minimum design speed of 20 mph shall be used. Where grades exceed 4 percent, a design speed of 30 mph shall be used.

8.5 SIDEWALK UNDERDRAINS (CHASES)

Sidewalk underdrains shall not interfere with the pedestrian's use of the sidewalk. Underdrains shall not be located within an access ramp, curb cut, or driveway.

8.6 PEDESTRIAN CROSSINGS

All crosswalks shall be marked in accordance with **Chapter 7, Traffic Control Devices.** Crosswalk markings will be required at all signalized intersections, school areas, and high pedestrian areas as designated by the City Engineer.

8.7 PEDESTRIAN REFUGE AREAS

For Arterials with raised medians and on splitter islands for roundabouts, a pedestrian refuge area shall be created in the median to increase pedestrian safety. See **Figure 5-8 and Figure 5- 9**.

CHAPTER 9 – ON-STREET BICYCLE FACILITIES DESIGN AND TECHNICAL CRITERIA

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CHAPTER 9 – ON-STREET BICYCLE FACILITIES DESIGN AND TECHNICAL CRITERIA

9.1 GENERAL

This chapter sets forth the minimum criteria to be used in the design of all bike lanes, bike paths, or other bicycles facilities within the City's rights-of-way.

9.1.1 Reference Documents

In this chapter, the AASHTO "Guide for the Development of Bicycle Facilities" as published by the American Association of State Highway and Transportation Officials, the National Association of City Transportation Officials Urban Bikeway Design Guide and the Manual on Uniform Traffic Control Devices were used as references.

9.1.2 Bicycle Master Plan

This subsection was developed based on the **City of Active Transportation Plan (ATP).** All projects shall optimize bicycle travel within the city by providing bicycle facilities in all new developments in accordance with this plan**.**

9.1.3 Obstructions

Manholes, utility poles or other appurtenances or obstructions, should not be located in bike lanes or bike paths.

9.2 ON-STREET BIKE LANES DESIGN REQUIREMENTS

9.2.1 On-Street Bike Routes

Specific streets are designated in the **City of Fayetteville Alternative Transportation and Trails Master Plan** as on-street bicycle routes. Streets designated as on-street bicycle routes shall be designed with additional width for bike lanes in accordance with the master street plan.

9.2.2 Width and Cross Sections

The bike lane shall be designed with widths shown in standard street classification sections. Bicycle lanes on one-way streets shall be on the right side of the street,

unless otherwise specified by the City Engineer. Bike lane width shall not be less than 5 feet measured from the face of curb or edge of pavement if no curb exists.

9.2.3 Signage and Striping

All designated bike lanes shall be signed and striped, as required by MUTCD and as required in **Chapter 7, Traffic Control Devices**.

9.2.4 Bike Lanes at Intersections

At the intersections where a separate right turn lane exists and is striped, the bicycle lane shall transition and be placed between the through lane and the right turn lane. The bike lane width shall remain the same as the approaching bike lane. See **Figures 5-8** and **5-9** in **Chapter 5, Intersections**.

CHAPTER 10 – NEIGHBORHOOD TRAFFIC SAFETY

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CHAPTER 10 – NEIGHBORHOOD TRAFFIC SAFETY

10.1 GENERAL

This chapter presents acceptable methods of neighborhood traffic calming that are determined by the City to be necessary for existing Local streets. This chapter also provides for specific design criteria for a number of traffic calming methods.

10.1.1 Intended Use

The necessity or desire for traffic safety and calming stems from the perception that local streets, particularly in residential areas, do not always function as intended. These roadways should be low traffic volume roadways used for direct access to residences on the street. They are also intended as a multi-modal system that is shared by vehicular, bicycle, and pedestrian traffic in a manner that minimally impacts residents in these areas.

10.2 TRAFFIC SAFETY PROBLEMS

The presence of too many vehicles traveling at high speeds through a neighborhood diminishes that neighborhood's quality of life. Traffic calming measures are intended to minimize these issues and return the quality of life to the neighborhood. Care must be taken by the designer so that the installation of traffic calming devices does not create unintended hazards that delay emergency response or jeopardize the safety of bicyclists, pedestrians or motorists.

10.2.1 Speeding

Speeding may occur on roadways that allow the driver to feel safe while exceeding the posted speed limit. Factors that contribute to this perception include long, unbroken lines of sight, steep roadway grades, wide roadways, low density developments, low pedestrian activity, and large building setbacks. In addition, speeding may occur when the street functions as a higher classification street than originally intended.

10.2.2 Measuring Speed of Roadway

The standard method of measuring speed on any street is the determination of the 85^{th} percentile speed. The 85^{th} percentile speed is the speed at which or below which 85 percent of the vehicles travel. If the 85^{th} percentile speed is at or below the posted speed limit, then speeding is not considered a problem. However, if the 85^{th} percentile speed is over the posted speed limit by 5 miles per hour or greater,

either the posted speed limit may be inappropriate or a speeding problem may exist.

10.2.3 Intrusion (Cut-Through Traffic)

Intrusion is increased volume or excessive non-local traffic along a neighborhood street. This cut-through traffic is caused by drivers who use a local street to go through a neighborhood and save time on their trip. These streets, which are less impeded than others, will often invite cut-through traffic. Routes that are perceived to be time-saving will attract more traffic. This increased cut-through traffic can cause local streets to function more like a collector.

10.2.4 Pedestrian Safety

Pedestrian safety negatively impacted by speeding vehicles, cut-through traffic, or a combination of these problems. The high concern areas are in the vicinity of neighborhood schools and parks or mid-block pedestrian crossings, particularly on streets with on-street parking. These areas require special consideration for the mobility and safety of the pedestrian.

10.3 TRAFFIC CALMING DESIGN CRITERIA

10.3.1 Intersection Bulb-Outs

Bulb-outs are areas of expanded curbing, at intersections, that narrow the overall street width and protect on street parking. See **Figure 10-1**.

A. Appropriate Locations

1. Appropriate for local streets.
2. Works well in downtown areas.
3. Primarily used at intersections.

B. Typical Uses

1. Reduce the crossing distance for pedestrians.
2. Improve the line of sight for pedestrians.
3. Make pedestrians more visible to oncoming traffic.
4. Slow traffic by funneling it through a narrower street opening.

C. Signing and Markings

Bulb-outs can be used with the standard intersection signage.

D. Other Considerations

Impact on roadway drainage must be addressed. Drainage may be provided by devices such as inlets, concrete channels, valley gutters, etc…

E. Advantages

1. Improve pedestrian safety.
2. Reduce vehicle speeds.
3. May slow right-turning vehicles.
4. Prevent parking close to intersections.
5. Can improve neighborhood appearance with landscaping.

F. Disadvantages

1. Can result in loss of on-street parking space.
2. May make it difficult to accommodate bicycle lanes.
3. Challenging drainage patterns.
4. Landscaping maintenance.

10.3.2 Center Island Narrowing

Center Island Narrowing are areas of curbed or painted islands located before an intersection or mid-block along the centerline of a street. See **Figure 10-2**.

A. Appropriate Locations

1. Appropriate for local streets.

B. Typical Uses

Slow traffic by narrowing the roadway with a median and to increase pedestrian safety by providing a refuge halfway across the street, so that only one direction of traffic need be crossed at a time.

C. Signing and Markings

Reflectors and street lighting are recommended to improve visibility.

D. Advantages

1. Improve pedestrian safety.
2. Reduce vehicle speeds.
3. Can improve neighborhood appearance with landscaping.

E. Disadvantages

1. Can result in loss of on-street parking space.
2. May make it difficult to accommodate bicycle lanes.
3. Landscaping maintenance.
4. May restrict access.

10.3.3 Gateway Treatment

Gateway Treatments are short medians at the entrance to a residential street. See **Figure 10-3**.

A. Appropriate Locations

1. Appropriate for local streets.

B. Typical Uses

Slow traffic as they turn into the street and to limit the exit to a single lane.

C. Signing and Markings

Reflectors and street lighting are recommended to improve visibility.

D. Advantages

1. Reduce vehicle entry speeds.
2. Prevents drivers from forming a second lane.
3. Can improve neighborhood appearance with landscaping.
4. Does not restrict access for residents.
5. Improve pedestrian safety.

E. Disadvantages

1. Can result in loss of on-street parking space.
2. May make it difficult to accommodate bicycle lanes.
3. Landscaping maintenance.

10.3.4 Oval Median

Oval Medians are curbed oval shaped medians located mid-block See **Figure 10-4**.

A. Appropriate Locations

1. Appropriate for local streets.
2. Appropriate on streets having volumes less than 3,500 vehicles per day.

B. Typical Uses

Slow traffic by narrowing the roadway with a median.

C. Signing and Markings

Reflectors and street lighting are recommended to improve visibility.

D. Advantages

1. Reduce vehicle speeds.
2. Can improve neighborhood appearance with landscaping.
3. Does not restrict access for residents.

E. Disadvantages

1. Can result in loss of on-street parking space.
2. May make it difficult to accommodate bicycle lanes.
3. Landscaping maintenance.

10.3.5 Chokers

Chokers are areas of curbing, typically mid-block, that narrow the overall street width. See **Figure 10-5**.

A. Appropriate Locations

1. Appropriate for local streets.
2. Appropriate on streets having volumes less than 3,500 vehicles per day.

B. Typical Uses

Slow traffic by funneling it through a narrower street opening.

C. Signing and Markings

The "Road Narrows" Sign (W5-1) with an appropriate "Advisory Speed" Sign (W13-1) should be used at least 150 feet in advance of the choker. Reflectors and street lighting are also recommended to improve visibility.

D. Other Considerations

Impact on roadway drainage must be addressed. Drainage may be provided by devices such as inlets, concrete channels, valley gutters, etc…

E. Advantages

1. Improve pedestrian safety.
2. Reduce vehicle speeds.
3. Can improve neighborhood appearance with landscaping.

F. Disadvantages

1. Can result in loss of on-street parking space.
2. May make it difficult to accommodate bicycle lanes.
3. Challenging drainage patterns.
4. Landscaping maintenance.

10.3.6 Chicanes

A chicane is a series of three curb bulb-outs staggered on alternating sides of the street, at a mid-block location, which forces vehicles to negotiate the narrowed roadway in a snake-like fashion. See **Figure 10-6.**

A. Appropriate Locations

1. Appropriate on local streets having volumes less than 3,500 vehicles per day.
2. Appropriate on two-lane, two-way streets or on one-lane, one-way streets.

B. Typical Uses

1. Slows vehicles by forcing motorists to weave through the bulb-outs.

C. Signing and Markings

1. The "Road Narrows Sign" (W5-1) with an appropriate "Advisory Speed Sign" (W13-1) should be used at least 150 feet in advance of the chicane. Object Markers (OM-3R, OM-3L), may be installed within the Chicanes if necessary. Reflectors, street lighting and landscaping are also recommended to improve visibility.

D. Other Considerations

1. Traffic volumes should be balanced in each direction. Chicanes lose effectiveness when volumes are significantly unbalanced.
2. Chicanes may not be appropriate in areas with high truck traffic.
3. Avoid locations where grades exceed 8 percent.
4. Placement of chicanes will depend on site conditions and driveway locations.

E. Advantages

1. Reduce vehicle speeds.
2. Reduce traffic volume.
3. May reduce collisions.
4. Traffic noise may be reduced due to lower speeds and volume.
5. Can improve neighborhood appearance with landscaping.

F. Disadvantages

1. Can result in loss of on-street parking space.
2. With two-lane chicanes, motorists may cross the centerline to maintain a straight line of travel.
3. Landscaping maintenance.

10.3.7 Two-Lane Slow Point

A Two-Lane Slow Point is a pair two islands with an angled median in between, at a mid-block location, which forces vehicles to negotiate the narrowed roadway in a snake-like fashion. See **Figure 10-7.**

A. Appropriate Locations

1. Appropriate on local streets having volumes less than 3,500 vehicles per day.
2. Appropriate on two-lane, two-way streets or on one-lane, one-way streets.

B. Typical Uses

1. Slows vehicles by forcing motorists to weave through the Slow Point.

C. Signing and Markings

1. The "Road Narrows Sign" (W5-1) with an appropriate "Advisory Speed Sign" (W13-1) should be used at least 150 feet in advance of the Slow Point. Object Markers (OM-3R, OM-3L), may be installed within the Slow Point if necessary. Reflectors, street lighting and landscaping are also recommended to improve visibility.

D. Other Considerations

1. Traffic volumes should be balanced in each direction. Slow Points lose effectiveness when volumes are significantly unbalanced.
2. Slow Points may not be appropriate in areas with high truck traffic.
3. Avoid locations where grades exceed 8 percent.
4. Placement of Slow Points will depend on site conditions and driveway locations.

E. Advantages

1. Reduce vehicle speeds.
2. Reduce traffic volume.
3. May reduce collisions.
4. Traffic noise may be reduced due to lower speeds and volume.
5. Can improve neighborhood appearance with landscaping.

F. Disadvantages

1. Can result in loss of on-street parking space.
2. Landscaping maintenance.

10.3.8 Traffic Circles

Traffic circles are raised islands located in the center of an unsignalized intersection. All traffic must negotiate the circle and circulate in a counterclockwise direction. See **Figure 10-8**.

A. Appropriate Locations

1. Appropriate on local streets having volumes less than 3,500 vehicles per day.
2. Appropriate on streets without high pedestrian or left-turning volumes.

B. Typical Uses

1. Slows vehicles due to the horizontal deflection.

C. Signing and Markings

1. The use of the "Advance Traffic Circle Warning Sign" (W6-4) with an appropriate "Advisory Speed Sign" (W13-1) is recommended in advance of the first traffic circle encountered on each street.

D. Other Considerations

1. Depending on the intersection configuration, the shape of the traffic circle may not actually be round.
2. Turning analysis should be completed to ensure that the design vehicle can negotiate the circle. A mountable concrete apron may be used to accommodate emergency service vehicles, trucks and buses.
3. Traffic circles may require additional street lighting.

E. Advantages

1. Reduce vehicle speeds.
2. Reduces the number of potential conflict points at an intersection.
3. May reduce collisions.
5. Can improve neighborhood appearance with landscaping.
6. Creates a visual obstruction that deters through traffic.

F. Disadvantages

1. May make it difficult for emergency vehicles, buses, and trucks to turn left.
2. May require removal of some on-street parking. The prohibition of parking for 30 feet from the intersection is recommended.
3. Landscaping maintenance.
4. Additional right of way may be necessary.

10.3.9 Textured Crosswalks

Textured crosswalks are the use of pavers, imprinted concrete/asphalt, or other materials to demarcate crosswalks and alert motorists that they are entering a pedestrian-friendly area.

A. Appropriate Locations

1. Appropriate on all street classifications where high pedestrian volume exists.
2. May be used on streets posted up to 45 mph.

B. Typical Uses

1. Often used in combination with raised crosswalks, raised intersections or bulb-outs.

C. Advantages

1. Improved street appearance.
2. Alerts motorist to the possible presence of pedestrians.

D. Disadvantages

1. Virtually no effect on traffic speeds or volumes.
2. Extra noise may be produced from vehicles passing over the textured surface.
3. Heavily textured surface may present a traction problem for bicyclists, wheelchairs or disabled persons.

10.3.10 Speed Tables

A speed table is a raised surface on the roadway that is typically 3” in height and 12 to 22 feet in length. See **Figure 10-9 and 10-10.**

A. Appropriate Locations

1. Appropriate on local streets having volumes less than 3,500 vehicles per day with posted speeds of 30 mph or less.
2. Primarily used in mid-block locations.

B. Typical Uses

1. Within typical residential travel speeds, speed tables encourage motorists to slow to a safe speed at or below the speed limit.

C. Signing and Markings

1. The Speed Table Warning Sign (W16-1) is recommended to be installed 100 feet in advance of speed tables, at the table, or in both locations. For a series of tables, the sign may be used at the first table in the series,
2. The pavement markings as shown in Figures 10-4 and 10-5 shall be used for all speed tables.

D. Other Considerations

1. Speed tables should be placed 250 to 600 feet apart.
2. Typically, speed tables should not be placed within 150 feet of an intersection.
3. Speed tables should not be used on curves.
4. Speed tables should not be used on streets with a grade of 8% or greater.
5. Speed tables should not be used on streets without curbing.

E. Advantages

1. Reduce vehicle speeds.
2. Relatively inexpensive to install and maintain.

F. Disadvantages

1. Drainage must be accommodated.
2. Should be avoided on emergency routes.
3. Rutting and pavement damage in retro-fit situations.

10.3.11 Raised Crosswalks

Raised crosswalks are marked and elevated pedestrian areas that are an extension of the sidewalk at intersections or mid-block locations. Raised crosswalks are typically 3 to 6 inches above street level. See **Figure 10-11**.

A. Appropriate Locations

1. Appropriate on local streets having volumes less than 3,500 vehicles per day with posted speeds of 30 mph or less.

B. Typical Uses

1. Reduce vehicle speeds.
2. Improve visibility of pedestrians.

C. Signing and Markings

1. The “Raised Pedestrian Crossing Warning Sign” (W11A-3) is recommended to be installed with each raised pedestrian crossing.

D. Other Considerations

1. Most appropriately used at areas with significant pedestrian crossings.
2. Most effective when combined with textured crosswalks and bulb-outs.
3. Drainage inlets should be installed on the uphill side of the raised crosswalk.
4. All ADA requirements must be met.

E. Advantages

1. Reduce vehicle speeds.
2. Improves visibility of pedestrians.

F. Disadvantages

1. Drainage must be accommodated.
2. May slow emergency vehicles.

10.3.12 Raised Intersections

Raised Intersections are intersections, including crosswalks, which are raised 3 to 6 inches above street level. See **Figure 10-12.**

A. Appropriate Locations

1. Commonly found in commercial areas and business districts with high pedestrian activity.
2. They are appropriate on local and collector streets.
3. They are appropriate on streets with volumes up to 10,000 ADT.

B. Typical Uses

1. Reduce vehicle speeds on all approaches.
2. Decrease conflicts between vehicles and pedestrians by better demarcating crossing areas and elevating pedestrians above the street.

C. Signing and Markings

1. Advance warning signs should be posted. The "Raised Pedestrian Crossing" sign (W11A-3) is recommended.

D. Other Considerations

1. If raised intersections are the same height as the surrounding curb, a slight lip or other tactile measure should be used as a warning to the visually impaired.
2. Textured pavement treatments and curb extensions are often used in conjunction with raised intersections.

E. Advantages

1. Improves visibility of pedestrians.
2. Visual enhancement.
3. Reduction in vehicle speeds.

F. Disadvantages

1. Expensive to construct.
2. May slow emergency vehicles.
3. May disrupt drainage.

10.3.12 On-Street Parking

On-street parking creates the appearance of a narrower roadway. The proximity of parked vehicles and opening doors tends to slows traffic.

A. Appropriate Locations

1. Commonly found in commercial areas and business districts, but may be used on any street of adequate width.

B. Typical Uses

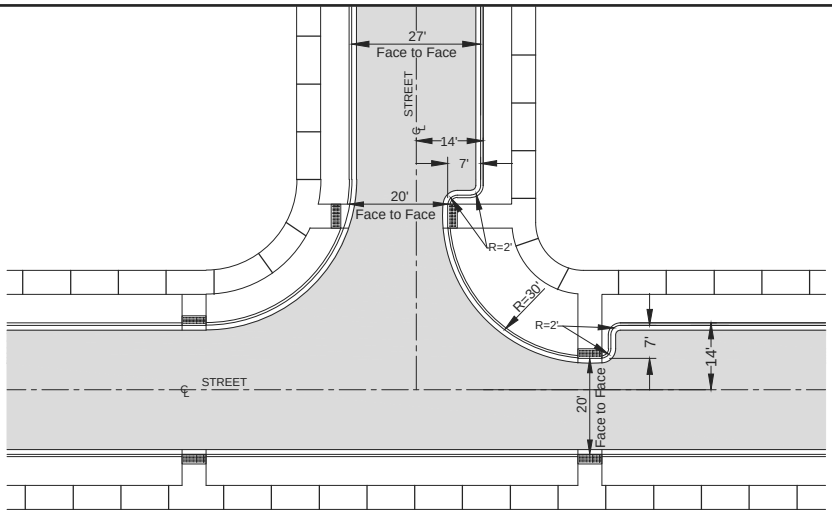
1. Reduce vehicle speeds.
2. Provide additional parking spaces for businesses and residents.

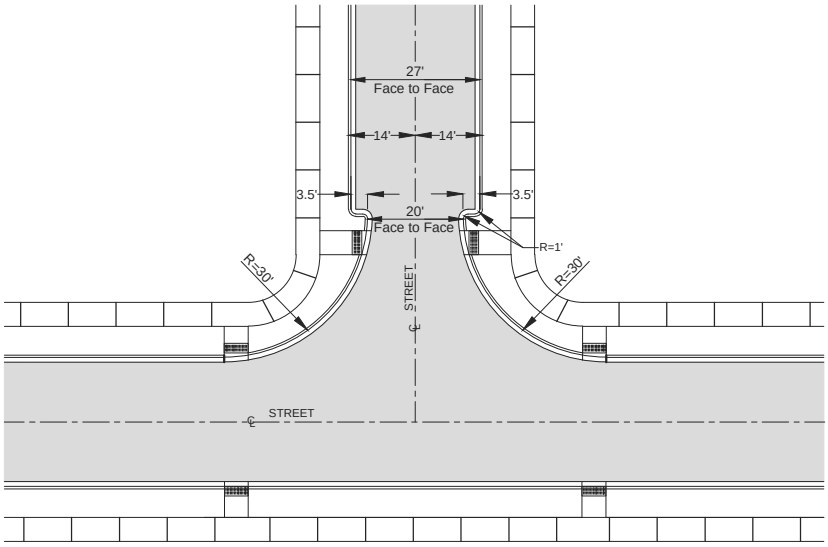
C. Advantages

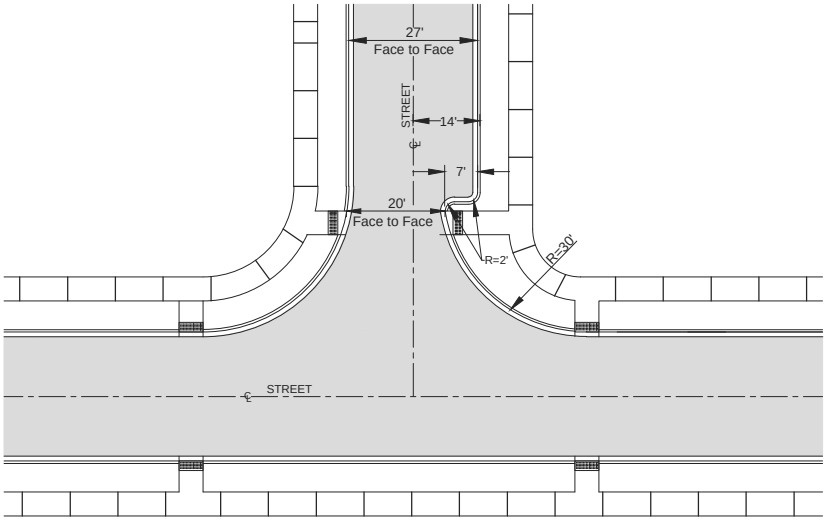
1. Creates a buffer between pedestrians and moving vehicles.
2. Reduction in vehicle speeds.

D. Disadvantages

1. ROW Impacts
2. Disruption of traffic flow while motorist is parking.
3. May disrupt drainage.





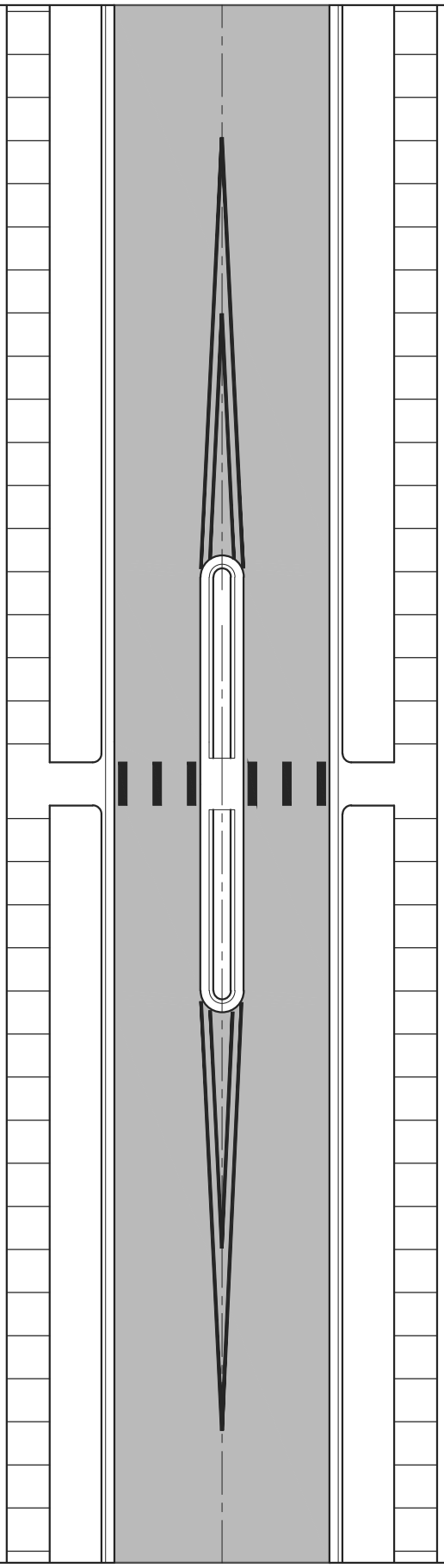


CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE:	DATE:	FIGURE:
MINIMUM STREET STANDARDS	October 1, 2014	**10-1**

DESCRIPTION:

INTERSECTION BULB-OUT



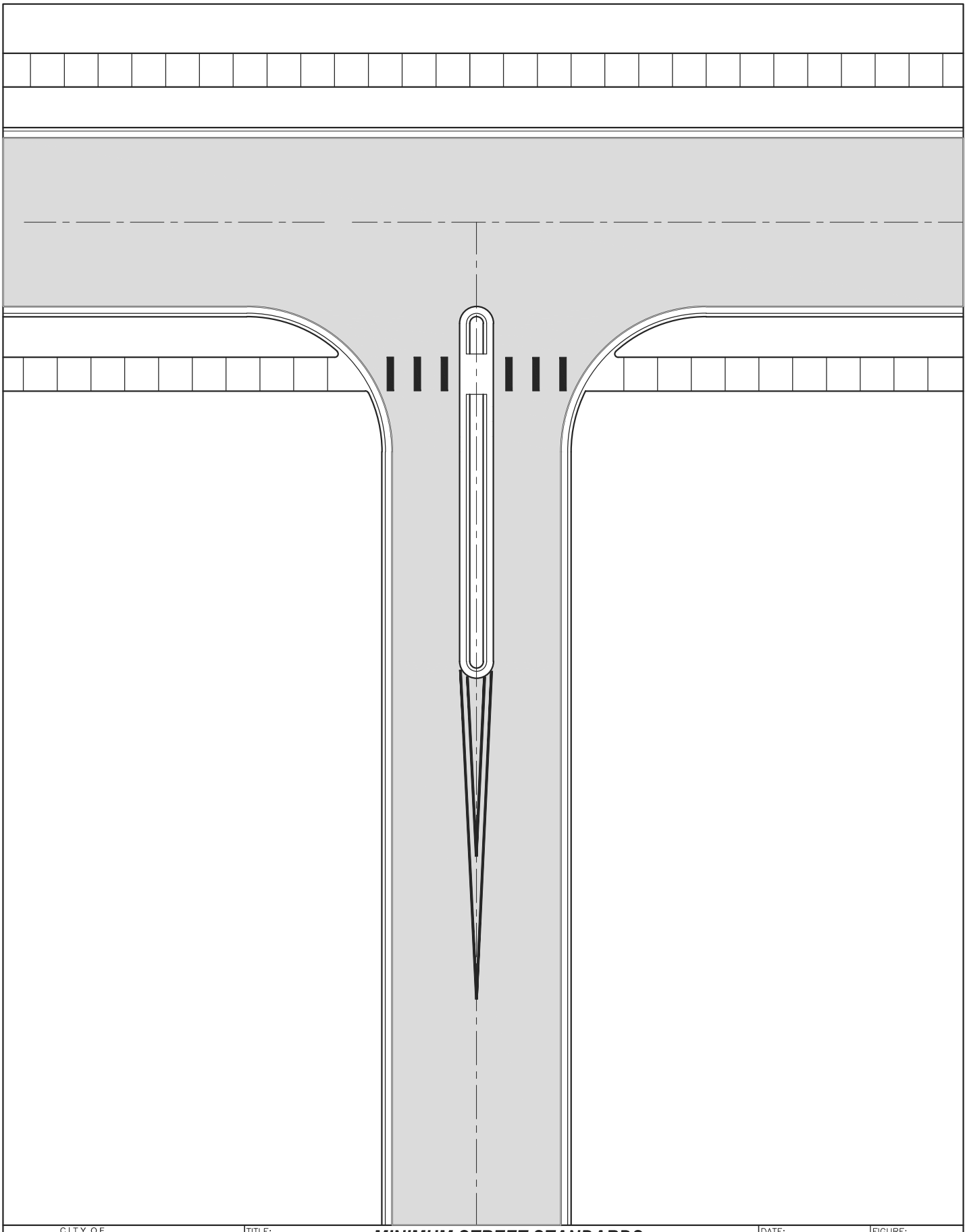
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE: ***MINIMUM STREET STANDARDS***

DATE: March 3, 2015

FIGURE: **10-2**

DESCRIPTION: CENTER ISLAND NARROWING



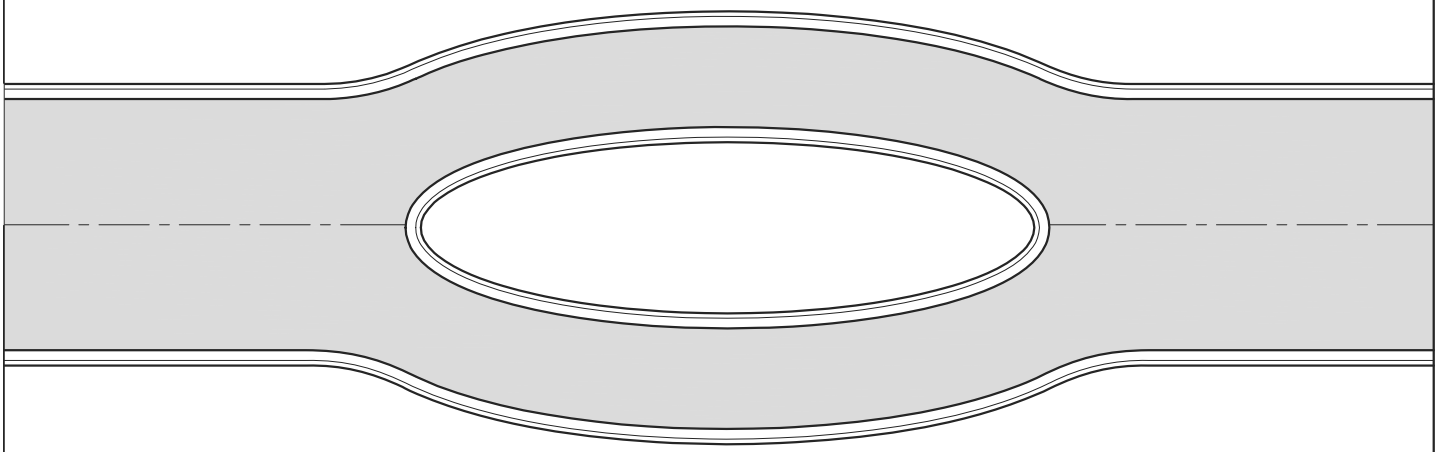
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE: ***MINIMUM STREET STANDARDS***

DATE: March 3, 2015

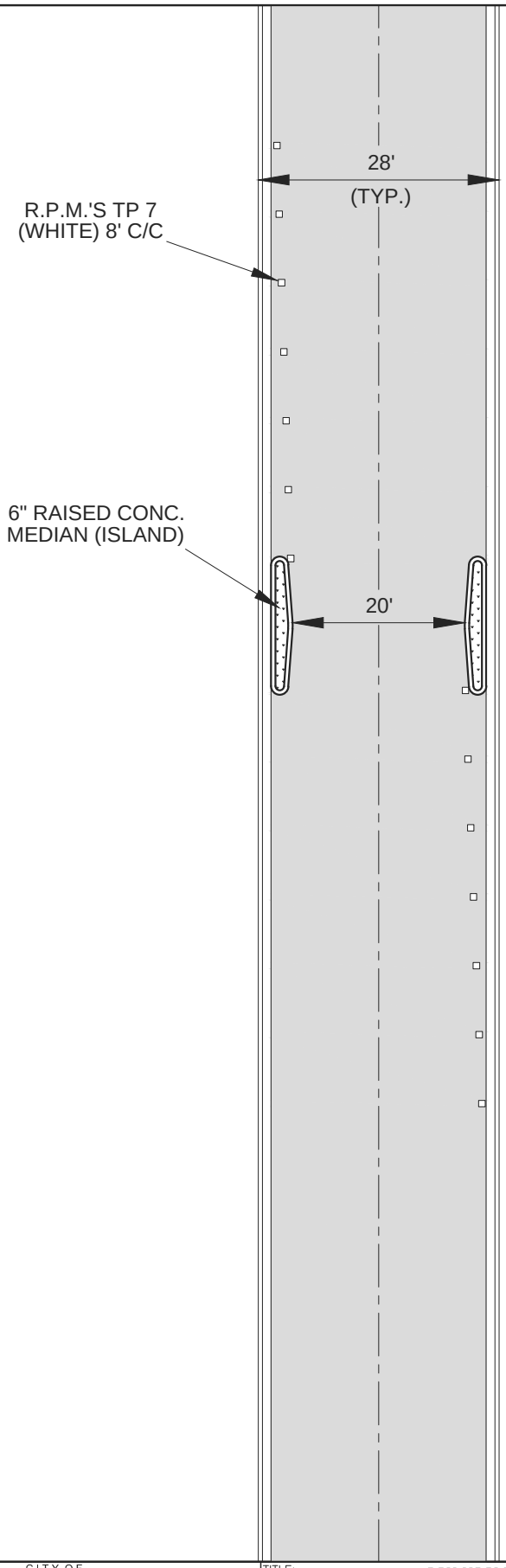
FIGURE: **10-3**

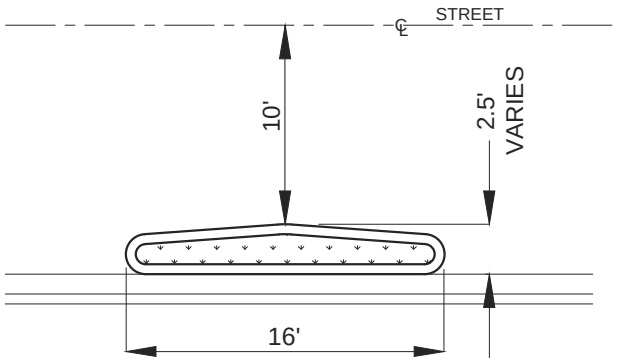
DESCRIPTION: Gateway Treatment



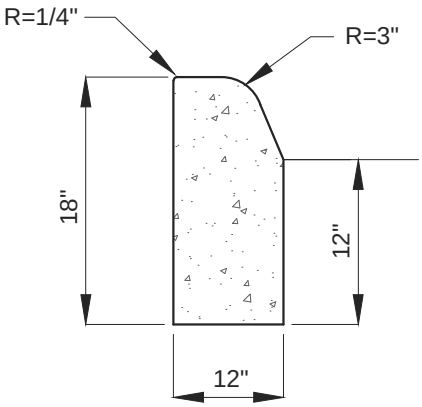
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE:	DATE:	FIGURE:
MINIMUM STREET STANDARDS	March 2, 2015	**10-4**
DESCRIPTION: TWO-LANE SLOW POINT		





CHOKER DETAIL
28' ROAD WIDTH



TYPE 'C' CONCRETE CURB

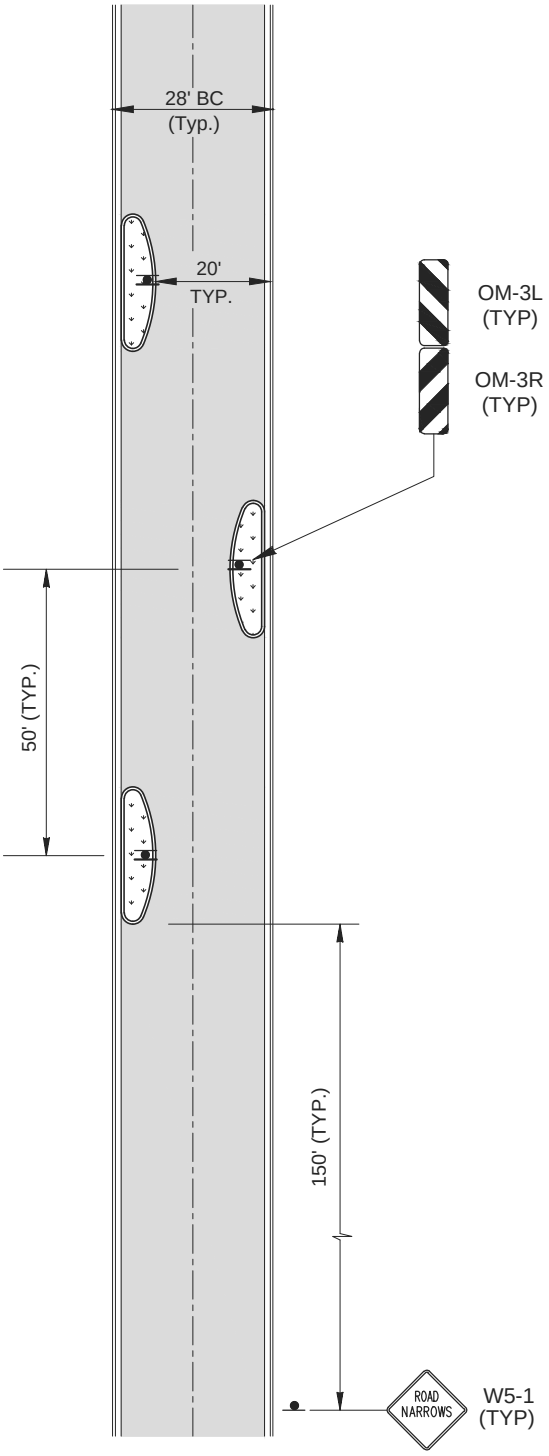
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

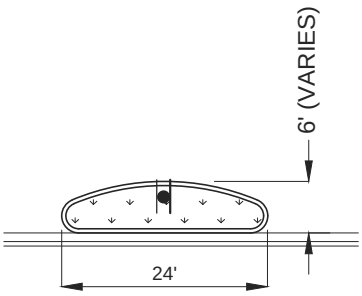
TITLE: ***MINIMUM STREET STANDARDS***

DATE: October 1, 2014

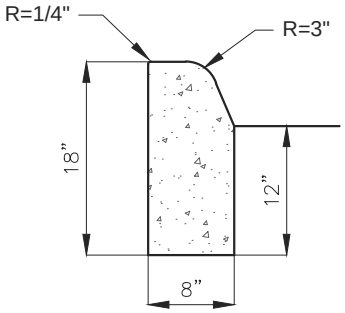
FIGURE: **10-5**

DESCRIPTION: CHOKER



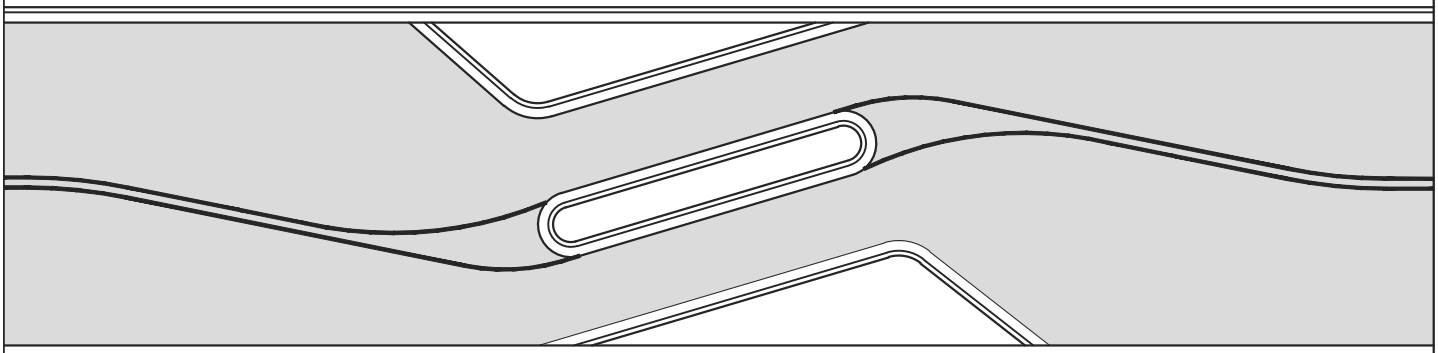


28' ROAD WIDTH



TYPE 'C' CONCRETE CURB

CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: ***MINIMUM STREET STANDARDS***	DATE: February 23, 2015	FIGURE: **10-6**
	DESCRIPTION: CHICANE		



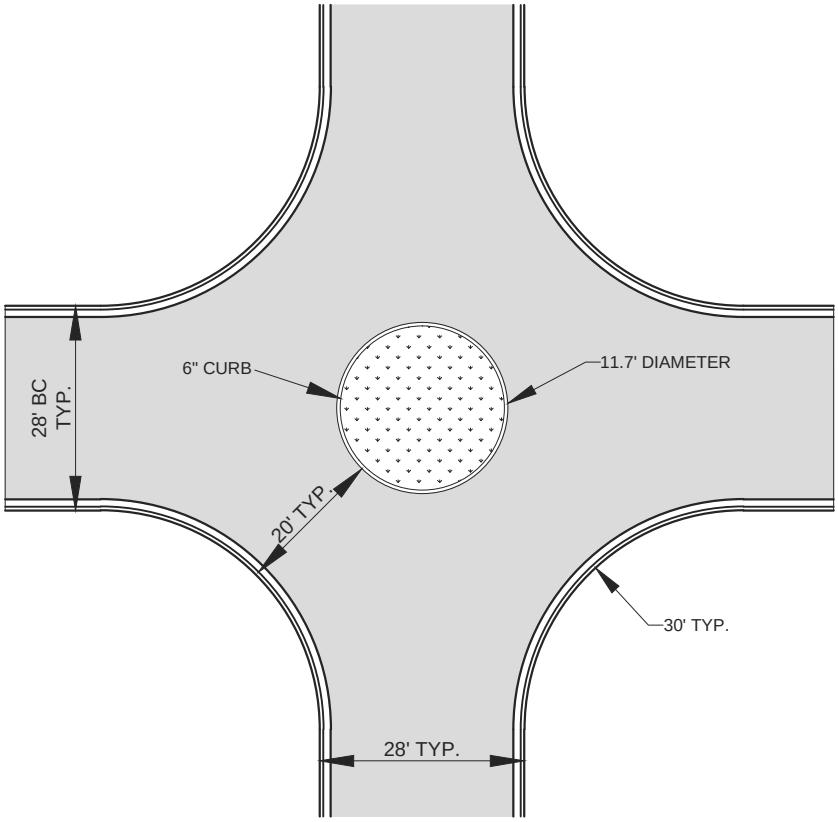
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

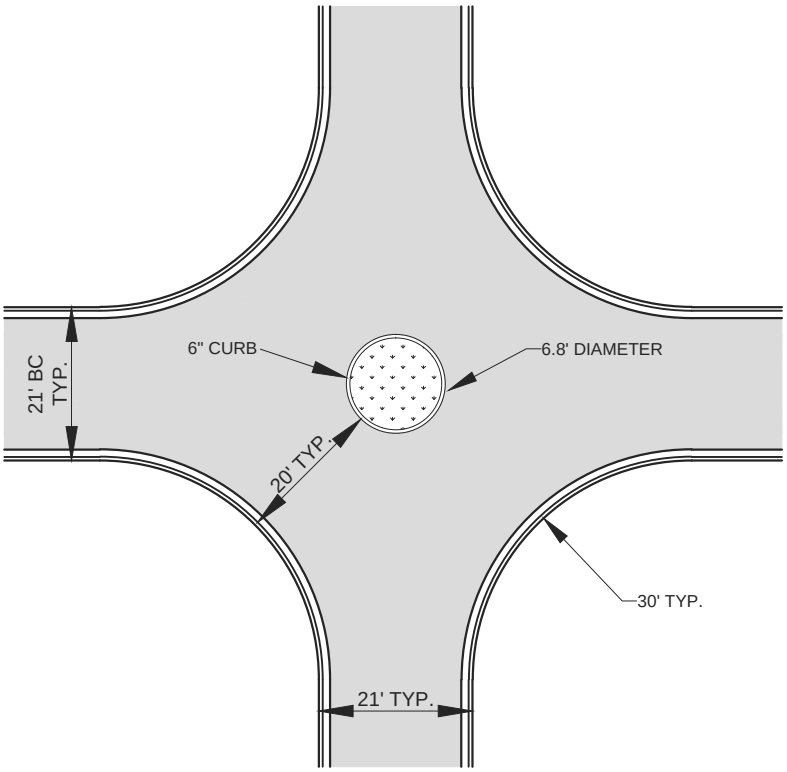
TITLE: ***MINIMUM STREET STANDARDS***

DATE: March 2, 2015

DESCRIPTION: TWO-LANE SLOW POINT

FIGURE: **10-7**





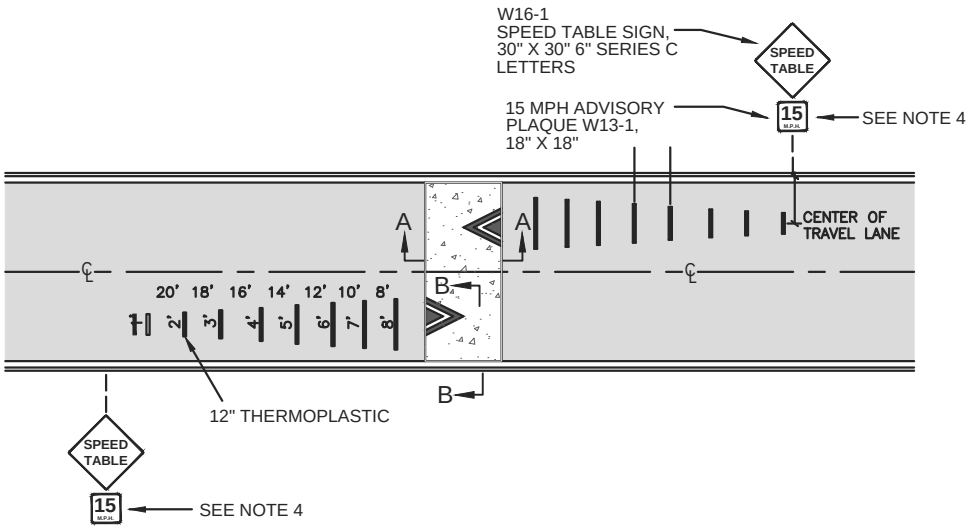
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE: **MINIMUM STREET STANDARDS**

DATE: February 23, 2015

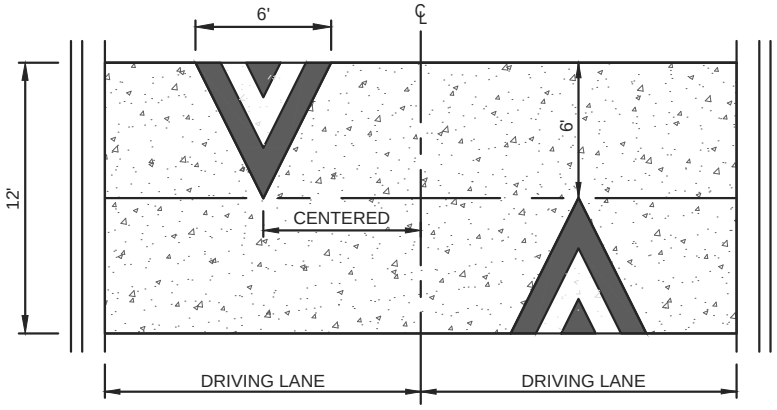
DESCRIPTION: TRAFFIC CIRCLE

FIGURE: **10-8**

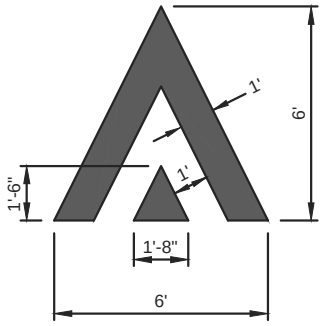


SPEED TABLE MARKING AND SIGNING

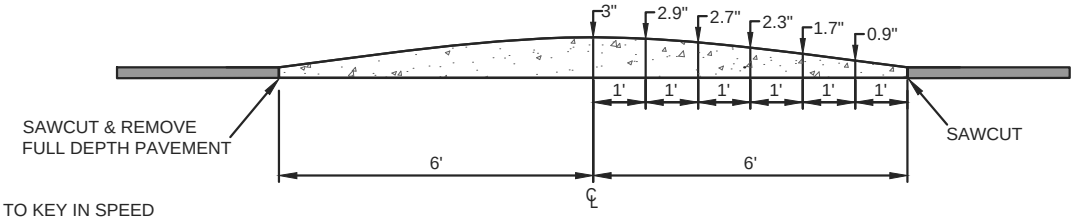
Not to Scale



MARKING DETAIL



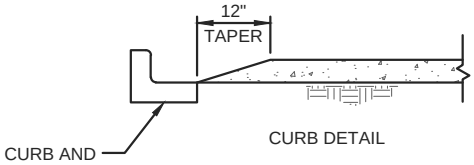
CHEVRON DETAIL



SECTION A-A

NOTES:

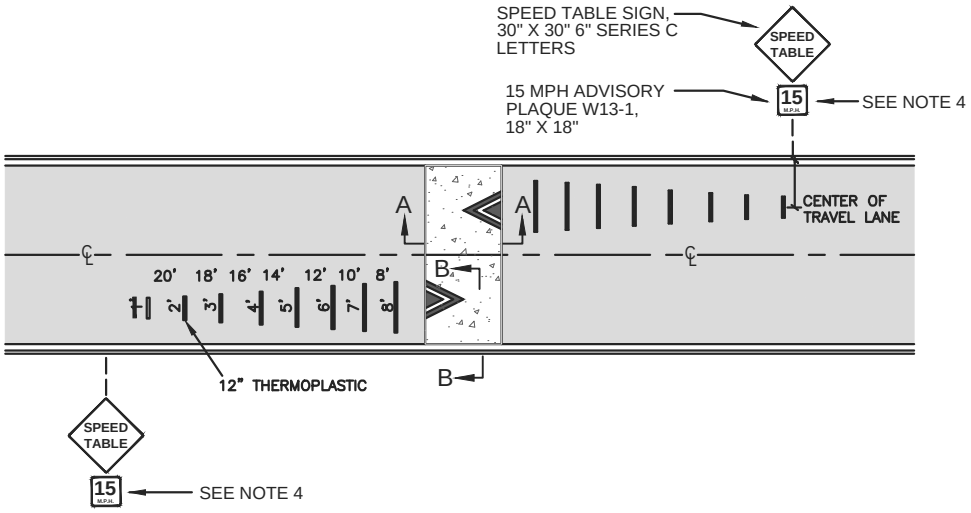
1. SAWCUT OR FEATHER GRIND TO KEY IN SPEED TABLE. SEE SECTION A-A.
2. SIGN LOCATIONS SHALL BE VERIFIED BY THE ENGINEER PRIOR TO INSTALLATION.
3. SPEED TABLE CHEVRON MARKING SHALL BE WHITE THERMOPLASTIC, HEAT FUSED PREFORMED, 125 MIL., OR EQUAL APPROVED BY THE ENGINEER.
4. FOR A SERIES OF SPEED TABLES, USE THE ADVISORY SPEED PLAQUE AT ONLY THE FIRST SPEED TABLE IN EACH DIRECTION OF TRAVEL.
5. SPEED TABLES SHALL BE CONSTRUCTED OF PORTLAND CEMENT CONCRETE 3500 PSI MIN.



CURB DETAIL

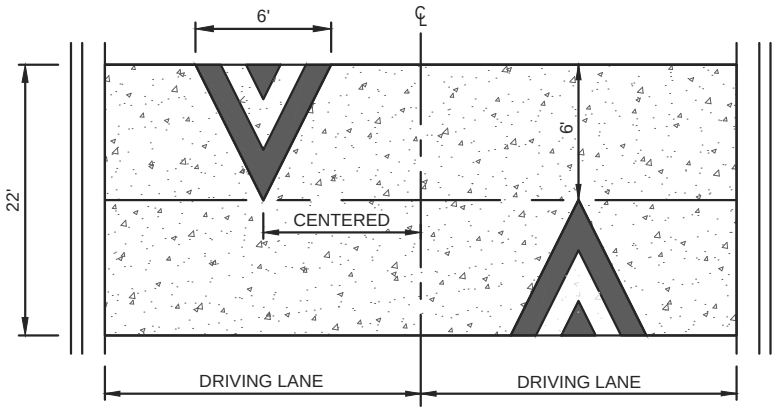
SECTION B-B

CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: MINIMUM STREET STANDARDS	DATE: February 23, 2015	FIGURE: 10-9
	DESCRIPTION: SPEED TABLE		

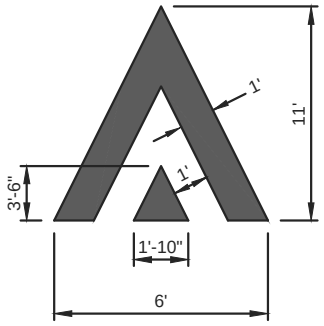


SPEED TABLE MARKING AND SIGNING

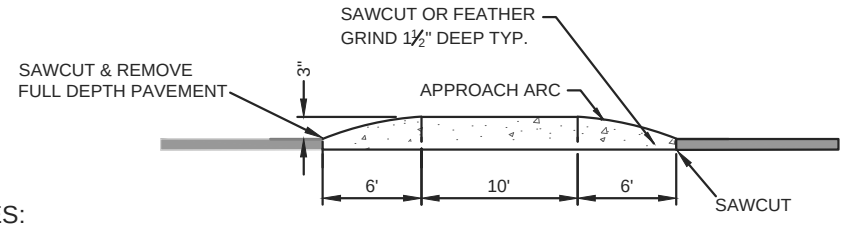
Not to Scale



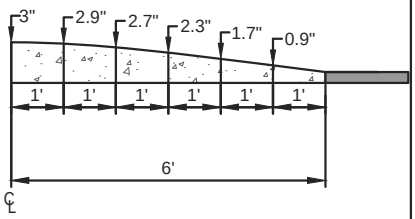
MARKING DETAIL



CHEVRON DETAIL



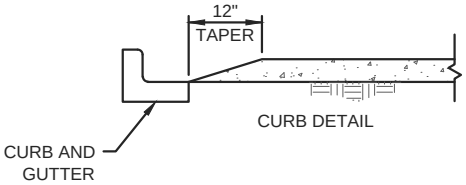
SECTION A-A



APPROACH ARC DETAIL

NOTES:

1. SAWCUT OR FEATHER GRIND TO KEY IN SPEED TABLE. SEE SECTION A-A.
2. SIGN LOCATIONS SHALL BE VERIFIED BY THE ENGINEER PRIOR TO INSTALLATION.
3. SPEED TABLE CHEVRON MARKING SHALL BE WHITE THERMOPLASTIC, HEAT FUSED PREFORMED, 125 MIL., OR EQUAL APPROVED BY THE ENGINEER.
4. FOR A SERIES OF SPEED TABLES, USE THE ADVISORY SPEED PLAQUE AT ONLY THE FIRST SPEED TABLE IN EACH DIRECTION OF TRAVEL.
5. SPEED TABLE TO BE INSTALLED USING CITY PROVIDED TEMPLATE, 48 HOURS NOTICE REQUIRED.
6. SPEED TABLES SHALL BE CONSTRUCTED OF PORTLAND CEMENT CONCRETE 3500 PSI MIN.



SECTION B-B

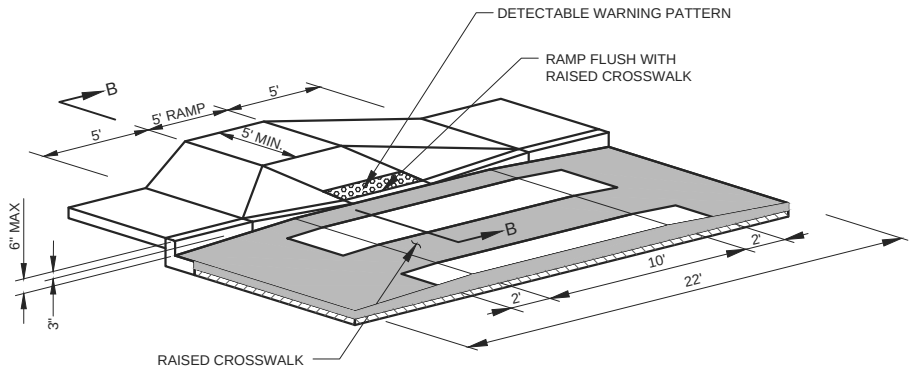
CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE: **MINIMUM STREET STANDARDS**

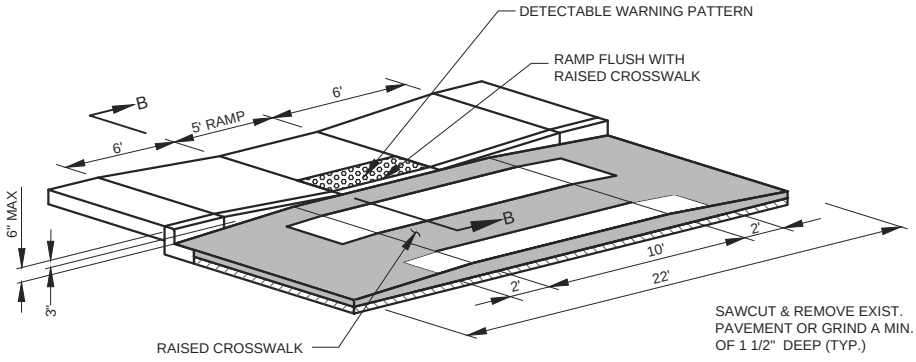
DATE: February 23, 2015

DESCRIPTION: ELONGATED SPEED TABLE

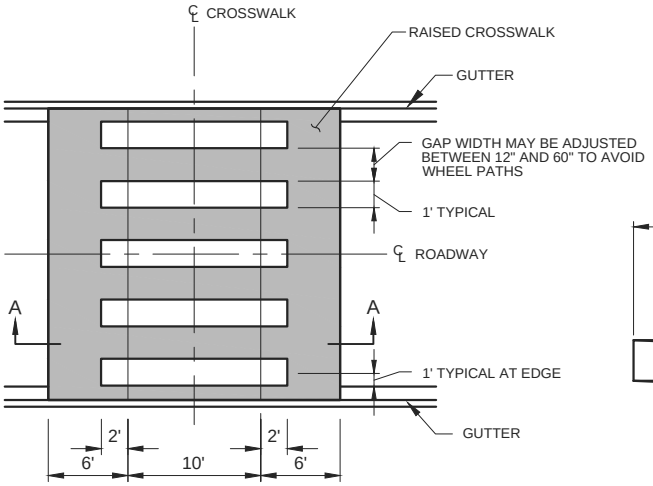
FIGURE: **10-10**



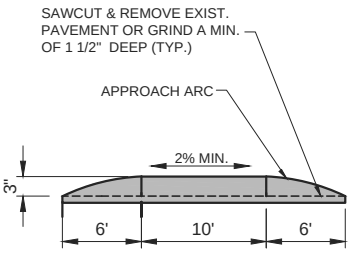
MODIFIED SIDEWALK RAMP TYPE 1



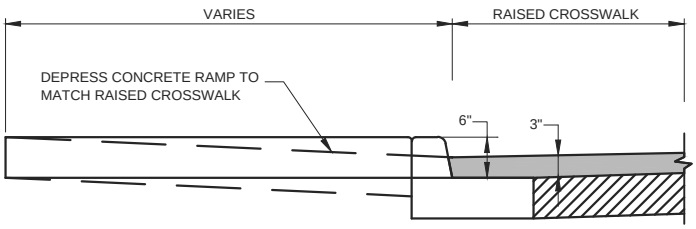
MODIFIED SIDEWALK RAMP TYPE 2



MARKING DETAIL

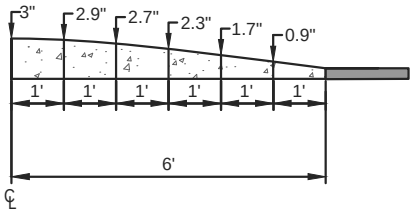


SECTION A-A



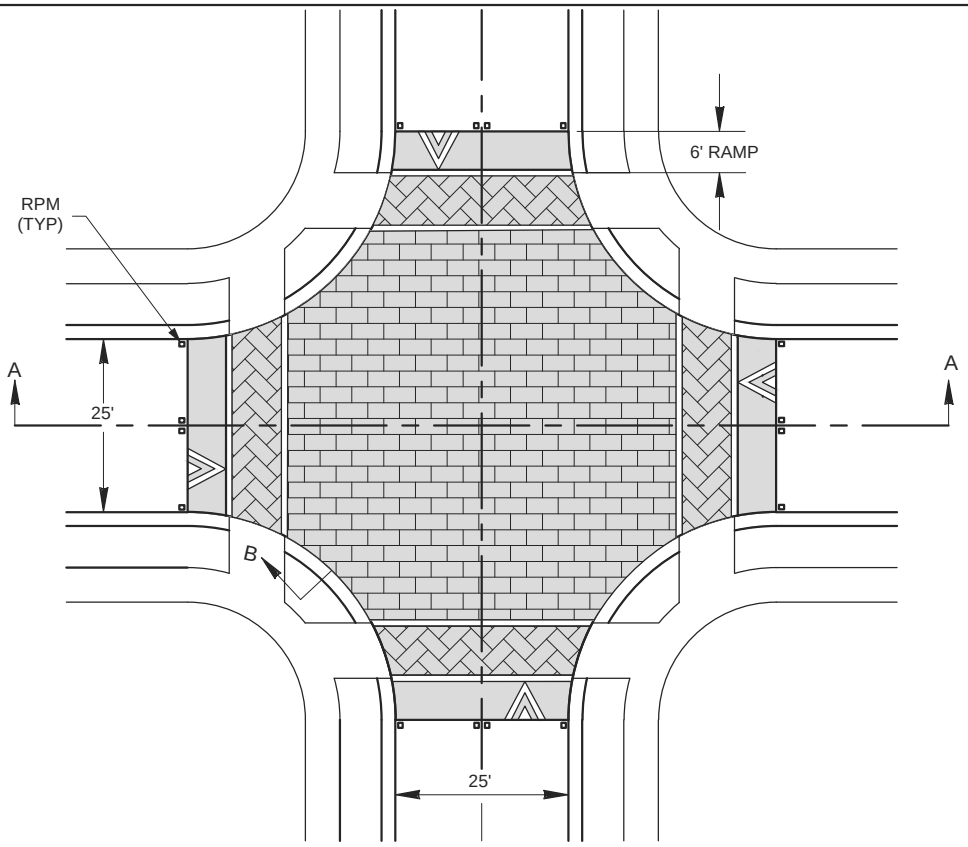
SECTION B-B

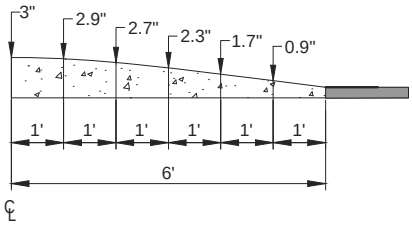
NOTE: LOCATION SHOULD TAKE INTO CONSIDERATION PROXIMITY TO DRAINAGE STRUCTURES, SINCE THE FLOW IN THE GUTTER WILL BE OBSTRUCTED BY THE CROSSWALK. ADDITIONAL INLETS MAY NEED TO BE CONSTRUCTED TO PREVENT PONDING.



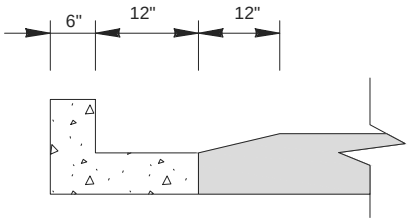
APPROACH ARC DETAIL

CITY OF Fayetteville ARKANSAS ENGINEERING DIVISION	TITLE: **MINIMUM STREET STANDARDS**	DATE: February 23, 2015	FIGURE: **10-11**
	DESCRIPTION: RAISED CROSSWALK		





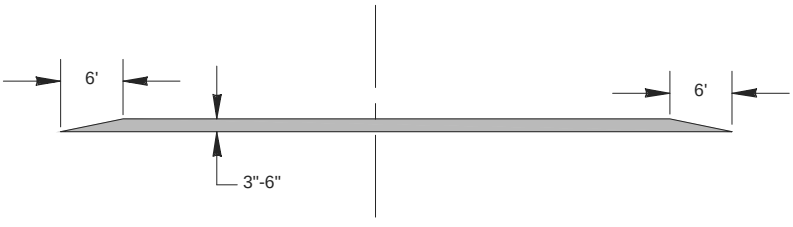
APPROACH ARC DETAIL



SECT. B–B

NOTES:

1. MINIMUM 1% SLOPE REQUIRED IN ALL AREAS FOR DRAINAGE.
2. A 30" X 30" YELLOW WARNING SIGN "RAISED PEDESTRIAN CROSSING" (W11A-3) MAY BE REQUIRED ON ALL APPROACHES NOT CONTROLLED BY A STOP SIGN.
3. INTERSECTION HUMP MAY BE CONSTRUCTED USING ASPHALT OR CONCRETE, PER CITY ENGINEER.
4. CONSTRUCT INTERSECTION HUMP USING 4000 PSI HIGH/EARLY CONCRETE REINFORCED WITH 6 X 6 - W2.9 X W2.9 WELDED WIRE FABRIC.
5. CONCRETE WILL BE COLORED AND TOP STAMPED WITH TEXTURE PER CITY ENGINEER.
6. CONSTRUCT INTERSECTION HUMP USING ASPHALTIC CONCRETE IN ACCORDANCE WITH SECTION 402 OF THE A.H.T.D SPECIFICATIONS, CURRENT EDITION.
7. APPLY PAVEMENT MARKINGS USING WHITE THERMOPLASTIC, 125 MIL., IN THICKNESS IN ACCORDANCE WITH A.H.T.D. STANDARD SPECIFICATIONS, CURRENT EDITION.
8. APPLY RAISED PAVEMENT MARKERS, TP 11 (YELLOW/YELLOW) (CENTERLINE) AND TP 13 (CLEAR/RED) (EDGE OF PAVEMENT), USING HEATED BITUMINOUS ADHESIVE IN ACCORDANCE WITH A.H.T.D. SPECIFICATIONS, CURRENT EDITION.



SECT. A–A

CITY OF Fayetteville ARKANSAS
ENGINEERING DIVISION

TITLE:	DATE:	FIGURE:
MINIMUM STREET STANDARDS	February 23, 2015	**10-12**
DESCRIPTION: RAISED INTERSECTION		

CHAPTER 11 – STREET INSPECTION AND TESTING PROCEDURES

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LIST OF TABLES

LIST OF FIGURES

This Chapter Contains No Figures

CHAPTER 11 – STREET INSPECTION AND TESTING PROCEDURES

11.1 QUALITY ASSURANCE

A. City Observation

A City Public Works Inspector will observe key steps of the construction process to insure compliance with these standards and the approved plans and specifications. Inspections will include but not be limited to: grading, erosion control, storm sewer installation, structures, non-structural concrete, sub-grade, base course, pavement and traffic control devices.

B. Inspection

The engineer of record shall provide inspection services for all work on the approved construction plans. The inspector shall keep a daily log of all construction activities and testing for the project. The logs shall be submitted to the City in pdf format on a weekly basis, unless otherwise approved.

The inspector will be responsible for coordinating the required testing to make sure that the contractor, testing lab and City representatives are present.

All inspection personnel shall be qualified to read and interpret the plans and specifications and to observe the construction and testing procedures to ensure compliance.

The costs of all inspections and oversight of the construction process shall be paid for by the Developer.

C. Testing

During the construction process testing from an independent laboratory is required on all infrastructure installation including soils, concrete, asphalt, and other applicable tests. All testing laboratories engaged in testing for projects shall be pre-qualified by the City Engineer.

These Standards state the minimum requirements for materials sampling, testing, and inspection. All tests shall be made and certified by an approved independent testing laboratory. All costs required and pertaining to testing, the work performed, and materials supplied to verify compliance with these Standards shall be the responsibility of the Developer.

The use of the testing laboratory's services does not relieve the Developer of the responsibility to furnish the required materials and to perform the required construction in full compliance with these Standards. Passing test results do not constitute acceptance of the work or materials represented by the test. The Developer is responsible for quality control of their work.

In various sections of these Standards, specific testing or other data is required by the City to insure that the intent of these Standards is fulfilled. The costs of such tests or other specific data where required by these Standards or on the approved plans shall be borne by the Developer. When evidence indicates that the work performed may not comply with these standards or the approved plan, the City Engineer may require additional tests or data beyond that required in these Standards or on the approved plans. The costs of such tests shall be borne by the Developer. Should such tests or additional data show a failure to meet these Standards or the approved plans, the Developer shall be responsible for all costs associated with repair or replacement of said failure.

D. Pavement Design Report

The pavement design report required in these Standards shall be submitted for review a minimum of 10 working days prior to any paving. Refer to **Chapter 6, Pavement Structure and Materials**.

E. Mix Designs

Pavement mix designs meeting the requirements of these Standards shall be furnished to the City Engineer a minimum of 10 working days prior to intended use of the mix. The mix design shall be reviewed and accepted by the City Engineer prior to use. If a mix design not accepted by the City is used, the City may require removal of all improvements placed with the unaccepted material.

F. Test Reports

Test reports submitted to the City shall include all tests performed on the project. All test reports shall show the location where the test was performed or at which work or batch is represented by the test. Test reports shall include all information specified in the **AASHTO**, ASTM, or local test procedure used. Prior to acceptance of each phase of a project, all final reports shall be submitted to the City indicating compliance with these specifications.

11.2 PAVEMENT

11.2.1 Subgrade

The subgrade will be evaluated by the City Public Works Inspector prior to the placement of the next course. Any necessary reworking, compaction, or replacement will be required prior to continuation. The approval is valid only to a time when weather conditions may have changed the condition of the subgrade.

Changes in weather such as freezing or precipitation, which may cause changes in the subgrade, will require re-approval of the subgrade.

A. Existing Material

Unsuitable material will be excavated to a depth as directed by the City Engineer or the geotechnical engineer, disposed of, and replaced with fill material meeting the requirements of **Chapter 6, Pavement Structure and Materials.**

If the existing material is acceptable for use as subgrade material, or modified to be suitable, the subgrade will be scarified to a depth of 8 inches and recompacted to conform to the requirements of this chapter.

B. Moisture and Density Requirements

All lifts in embankment areas shall be compacted to not less than 95% of the maximum density. The moisture content of the material shall be within 2% of optimum moisture content before compaction.

Maximum density will be determined using AASHTO T-99 (Standard Proctor). In-place field density measurements shall be determined using AASHTO T-191, T-233 or T-310.

Density requirements do not apply to portions of embankments constructed of materials such as rock that cannot be tested by approved testing methods.

C. Final Proof-Rolling

Final proof rolling of subgrade shall be required prior to taking density tests. Proof rolling shall be done with a fully loaded tandem-axle dump truck.

D. Testing Frequency

Density tests shall be taken every 300 feet for each lane or portion thereof. For streets less than 300 feet in length, a minimum of one test shall be taken for each lane**.** The Public Works Inspector shall determine the location of the tests.

E. Finished Subgrade

The subgrade shall be shaped for its full width to the required grade and cross section. The finished subgrade shall not vary at any point by more than 1/2" from the design elevation.

11.2.2 Base Course

The base course material shall be placed on a completed and approved subgrade or existing base that conforms to the grade and cross section shown on the plans. Base course shall not be placed on frozen subgrade.

A. Materials

Materials for aggregate base courses shall meet the requirements of Section 303 of the **AHTD Standard Specifications (2014 Edition)** for Class 7.

B. Moisture and Density Requirements

All lifts in embankment areas shall be compacted at substantially optimum moisture content to not less than 98% of the maximum density.

Maximum density will be determined using AASHTO T-180 (Modified Proctor). In-place field density measurements shall be determined using AASHTO T-310.

C. Thickness

The compacted base course shall be tested for thickness in the same general location of the density testing. The finished base course shall not vary at any point by more than ¼" from the design thickness.

D. Testing Frequency

Density tests shall be taken every 300 feet for each lane or portion thereof. For streets less than 300 feet in length, a minimum of one test shall be taken for each lane**.** The Public Works Inspector shall determine the location of the tests.

E. Finished Grade

The base course shall be shaped for its full width to the required grade and cross section. The finished base course shall not vary at any point by more than 1/2" from the design elevation.

11.2.3 Hot Mix Asphalt (HMA)

A. Materials

Materials for Hot Mix Asphalt Concrete base, binder and surface courses shall meet the requirements of the **AHTD Standard Specifications (2014 Edition)** as referenced in Section 6.4.4 of these standards. No "Marshall Mixes" are allowed within City right of way unless specifically authorized in writing by the City Engineer.

B. HMA Testing

All testing shall be done in accordance with AASHTO or ASTM as designated throughout this chapter.

Testing results for Asphalt Binder Content, VMA and Air Voids shall be provided by the contractor upon request by the City Engineer.

The pavement shall be cored at 500 foot intervals for each lane, or fraction thereof, in each lane. The core locations shall be chosen so as to accurately represent the quality of the asphalt placed in a particular area.

C. Density Requirements

Minimum asphalt density shall be 92% of the maximum theoretical density. No density of less than 90% shall be accepted. The asphalt where densities are less than 92% and greater than 90% shall be left in place and a penalty of 2% of the in-place construction cost of the deficient asphalt shall be paid to the City for each .10% deviation from the required density up to a maximum of 40 %. Where densities are less than 90%, the paving shall be removed and replaced.

When a deficient density is obtained, two additional cores shall be taken within 10' either side of the deficient core location. If the density of both of these cores is 92% or higher, then no additional cores are necessary and no penalty will be applied. If insufficient density is reported with the new cores, then additional cores shall be taken every 50 feet until the limits of the deficient asphalt have been established.

The asphalt density used for the purpose of computing the penalty shall be the average density over the deficient area. Only the deficient densities (from 90-92%) shall be used to calculate the average.

D. Thickness

Thickness measurements shall be taken for each core sample. The thickness measurement shall be averaged for each run of paving. A run shall be considered a portion of paving constructed in one day on one section of street. Multiple streets paved in one day will result in multiple runs.

Should any deviation be found, additional cores may be taken to define the horizontal limits of the deviation. When measurement of the core is not deficient by more than 1/4 inch from the design thickness, the pavement thickness will be considered to be within acceptable tolerance. When such measurement is deficient more than 1/4 inch from the design thickness, two additional cores at intervals not less than 50 ft will be taken and used to determine the average thickness for that area. When the average thickness of cores is deficient by more than 1/4 inch the City Engineer may require that the area be removed and replaced.

Maximum thickness used for averaging purposes shall be the specified thickness plus 1/2 inch.

E. Surface Tolerance

The finished surface of the pavement, when tested with a 10-foot straight edge parallel to the centerline or perpendicular across joints, will show variations as

measured from the testing face of the straight edge to the surface of the pavement, which shall not exceed 1/8 inch on surface course and 3/16 inch on binder course. Areas that do not meet the required surface accuracy shall be clearly marked and if the City Engineer requires repair, the contractor shall repair the pavement.

11.2.4 Portland Cement Concrete Pavement

A. Materials

Materials for Portland Cement Concrete Pavement shall meet the requirements of the latest edition of the **AHTD Standard Specifications.**

B. Concrete Testing

All testing shall be done in accordance with AASHTO or ASTM as designated throughout this chapter.

C. Concrete Roadway Inspection

1. Tolerances.
   a. Where the constructed surface varies from the design cross slope by more than 1/2 inch in 10 feet, the pavement shall be removed and replaced. This technique may not apply in areas with less than 2% cross slope.
   b. Areas showing high spots greater than 1/4 inch as measured with a 10-foot straight edge, but less than 1/2 inch, may be diamond ground to within the specification of 1/4 inch.
   c. Thickness Tolerance. The thickness of the pavement shall be determined by average caliper measurement of cores tested. A minimum of 1 core per 500 LF will be taken at random. Should any deviation be found, additional cores may be taken to define the horizontal limits of the deviation. When measurement of the core is not deficient by more than 1/4 inch from the design thickness, the pavement thickness will be considered to be within acceptable tolerance. When such measurement is deficient more than 1/4 inch and not more than 1 inch from the design thickness, two additional cores at intervals not less than 50 ft will be taken and used to determine the average thickness for that area. When the thickness of pavement is deficient by more than 1/4 inch the City Engineer may require that the area be removed and replaced.

2. Specifications.

a. All panels with cracks wider than 1/8 inch shall be repaired by total removal of the panel and replacement as required by the criteria herein.

b. All panel cracks 1/8 inch and narrower may be routed and sealed at the discretion of the City Engineer.

c. There shall be no more than one structural crack per panel. Panels with more than one structural crack shall be repaired by total panel removal and replacement.

d. All sections removed shall have edges parallel to adjacent panel joints.

e. All saw cuts for removal of slabs shall be full depth cuts.

f. No panel shall be allowed that has a crack meeting an adjacent panel at an angle more acute than 45 degrees to a finished edge or control joint.

g. All corner cracks to a panel shall be removed and replaced.

h. Any vertical differential movement across a crack greater than 3/16 inch shall be repaired by either partial or total panel removal and replacement.

i. All panels with faulted joints resulting from settlement and/or pumping of the edges shall be repaired by removal and replacement.

j. All manholes, water valves, range boxes, etc., shall be flush to 1/4 inch below the final surface roadway grade.

k. When an entire panel is removed, the panel shall be secured to the surrounding panels with 18” long ½”diameter smooth dowel bars placed at 12” centers.

Table 11-1
Materials Testing

Subgrade	AASHTO	ASTM	Frequency
Sampling	T87	D420	Per Soil Type Encountered
Soil Classification	M145	D3282 D2488/D2487	
Proctor			
Standard	T99/T310	D698	
Modified	T180/T310	D1557	
Density & Moisture Content	T191/T233/T310	D2922/D3017	1 per 300LF lane Min. 1 per lane
Hot Mix Asphalt			
Sampling	T168	D979	
Density			
Nuclear	--	D2950	As Directed by City
Coring	T166	D2726	1 per 500LF lane Min. 1 per lane
Concrete			
Sampling	T141	C172	
Mold and Cure	T23	C31	
Cylinder Tranport.	T23	C31	
Physical Properties			1 per 100 cy Min. 1 per day 1 per 1000 LF Curb
Slump	T119	C143	See Table 11-2
Air Content	T152	C231	
Comp. Strength	T22	C39	
Coring	T24	C42	As Directed by City
Comp. Strength	T24	C42	
Aggregate Base Course			
Gradation	T27	C136	1 Per Source
Proctor			
Modified	T180	D1557	
Standard	T99	D698	
Density & Moisture Content			1 per 300LF lane Min. 1 per lane

Table 11-2
Concrete Mix Designs

Concrete Class	Class A	Class B
28-Day Comp. Strength (psi)	3500	4000
Portland Cement (bags)	5.5	6.5
Max. Water/Cement Ratio	.49	.44
Slump Range (inches)	1-4	1-4
Air Entrainment (%)	4-7	4-7
Maximum Fly Ash Content	20%	20%

11.3 STRUCTURAL CONCRETE

This section delineates the testing, inspection, and related documentation requirements for all structures, including retaining walls, cast-in-place box culverts, and other concrete structures specified within.

11.3.1 Concrete Specifications

Materials

Class A or B concrete shall be used in drop inlets, junction boxes and others as specified.

Class B concrete shall be used in box culverts, bridges, retaining walls and other structures as specified.

11.3.2 Concrete Testing and Inspections

A. Structural and Inspection Requirements

The structural design Engineer or his representative, familiar with assumptions inherent in the structure design, shall inspect the construction in sufficient detail to confirm that the construction meets the requirements of the plans and specifications.

B. Foundation Testing and Inspection Requirements

Unstable foundation material shall be removed to a depth approved by the City Engineer below the finish grade elevation and be replaced with a material and construction procedure as approved by the City.

C. Inspection of Forms and False Work

1. The forms shall be clean of all dirt, mortar, and all foreign material. Forms that will later be removed shall be thoroughly coated with an approved form oil.
2. The forms shall be mortar tight and of a quality (in addition to the bracing) to withstand the pressures from deposited concrete.
3. Unless otherwise specified, forms for exposed surfaces shall be constructed with triangular fillets 3/4 inch at all exterior corners.

D. Inspection of Reinforcing Steel

1. Material Grade and Size. The material grade and size shall be as specified by the Designer on the certified construction plans.

2. Tying.

a. The intersections of all bars shall be tied in accordance with the following requirements: Slab bars shall be tied at every intersection around the periphery and at spacing according to bar sizes. Unless bar spacing is less than 12" in which case every other intersection shall be tied. However, in no case shall less than 30% of the intersections be tied.

b. Wall bars should be tied sufficiently to prevent shifting, at least 3 times in any bar length at every third or fourth intersection and at spaces according to bar sizes, staggered:

#5 and smaller - 3'0"
#6 to #9 - 4'0" to 5'0"
#10 to #11 - 6'0" to 8'0"

Upper and lower mats shall be tied or otherwise fastened at 4 foot maximum spacing in each direction. Minimum splice length shall be 24 bar diameters.

1) All reinforcing steel shall be supported with steel chair or precast mortar.

2) Reinforcing steel shall be clean and free of all foreign material before concrete is placed.

3) All clearances shall be in compliance with approved plans and specifications.

E. Concrete Testing and Inspections

1. Materials Specifications. The class of concrete used shall be in accordance with **Table 11-2**. Concrete that does not meet strength in 28 days is subject to removal.

2. Concrete Tests.

a. All testing shall be done in accordance with **AASHTO** or **ASTM** as designated in **Table 11-1**.

b. Maximum time allowed between sampling and casting cylinders shall not exceed 15 minutes. Cylinders shall be transported to the laboratory within 24 hours of casting but after the concrete has hardened, (see **AASHTO T23 or ASTM C-31**).

c. The slump test shall be performed in accordance with **AASHTO T119**. The air test shall be performed in accordance with **AASHTO T196** or

T121. Slump and air test measurements shall be taken with each cylinder series.

d. If compressive strength of cylinders does not meet the specified values, the Design Engineer shall recommend and the City Engineer shall approve the necessary mitigation measures needed.

F. Testing Frequency and Related Inspections

1. Testing frequency shall be in accordance with **Table 11-1**.
2. At least 4 compressive strength cylinders shall be taken from the same concrete delivery truck to provide design compliance testing at the laboratory. Two of the four specimens will be tested at 28 days for acceptance and 1 shall be tested at 7 days for information. The fourth cylinder shall only be necessary if the 28-day fails. Additional cylinders may be required, as directed by the City Engineer.

G. Placement (Inspection)

1. Concrete placement shall be done in a manner such that the concrete is not segregated or altered before placing. It shall not be allowed to free fall more than 5 feet. Concrete shall be placed in lifts not to exceed 18 inches.
2. A sufficient number of vibrators shall be used to properly consolidate the concrete as required.
3. Weepholes and drainage systems should be installed in the structure at the locations noted on the plans or specifications.
4. Construction joints and expansion joints shall be constructed in conformance with approved plans and specifications.

11.4 NON-STRUCTURAL CONCRETE

Non-structural concrete includes curb, gutter, sidewalks, driveways, crosspans and ADA ramps.

11.4.1 Concrete Specifications

A. Materials

Class A concrete shall be used in curb and gutter, sidewalks driveways, crosspans, ADA ramps and miscellaneous concrete items as specified. See **Table 11-2**.

B. General Specifications

1. Humps and Depressions. Any localized humps and/or depressions greater than 1/4 inch (as measured with a 10-foot straight edge) will require removal and replacement of the work in question.
2. Water Ponding. No ponding of water shall greater than 1/4 inch be allowed.
3. Flowline Depth. Curb and gutter flowline depth shall not vary from adopted standards by more than ± 1/4 inch, measured vertically from the top of curb to the gutter invert.
4. Cross Slope in Pedestrian Walks. Pedestrian walks shall have a maximum of 2.0 percent cross slope.
5. Joint Spacing. Contraction and construction joints shall be placed at a maximum spacing of 10 feet in curb and gutter, crosspans, trickle channels, etc. Refer to Chapter 8 for Sidewalk and Trail joint spacing.
6. Heave or Settlement of Sidewalk. Heave or settlement of sidewalk, relative to separate curb pour, greater than 1/4" shall be cause for corrective action.
7. Utility Placement. No utility facilities shall be placed in curb and gutter, sidewalk, crosspan, ADA ramp etc., unless specifically called out on the approved construction plans. This includes meter boxes, manholes, power poles, fire hydrants, water valves, etc.
8. Concrete Cracks.
   a. At the time of final acceptance, the repair of all cracks will be completed.
   b. Any section of concrete with longitudinal cracks or with cracks greater than 1/16" in width will require complete removal and replacement of that section between joints.
   c. Repair action for hairline cracks may be waived at the discretion of the City Engineer. For the purpose of this section, a hairline crack is one that is reasonably immeasurable and without separation as determined by the City Engineer.
9. Concrete Chips and Gouges.

   Chips and gouges in the concrete will be evaluated on an individual basis. If determined by the City to be unacceptable, then the section shall be removed and replaced.
10. Other Imperfections in Concrete Surface. Stress cracking, pop-outs, spalling, rain damage, graffiti, and other surface defects will remain discretionary and will usually require removal and replacement.

11. Final Grade.

a. A light broom finish shall be required.

b. All concrete work shall have the proper finished grade.

c. No abrupt changes in grade shall be allowed, i.e., curb returns from new to existing, driveway entrances, etc.

11.4.2 Concrete Testing and Inspections

A. Concrete Tests

1. Concrete Tests.

a. All testing shall be done in accordance with **AASHTO** or **ASTM** as designated in **Table 11-1**.

b. Maximum time allowed between sampling and casting cylinders shall not exceed 15 minutes. Cylinders shall be transported to the laboratory within 24 hours of casting but after the concrete has hardened, (see **AASHTO T23 or ASTM C-31**).

c. The slump test shall be performed in accordance with **AASHTO T119**. The air test shall be performed in accordance with **AASHTO T196** or **T121**. Slump and air test measurements shall be taken with each cylinder series.

d. If compressive strength of cylinders does not meet the specified values, the Design Engineer shall recommend and the City Engineer shall approve the necessary mitigation measures needed.

2. Grade Verification of Gutter Flowline.

After completion of curb and gutter, including curb returns and crosspans, and prior to installation of asphalt, the new installation must be flow-tested with water in the presence of the Public Works Inspector to confirm that there are no areas that hold water. The City Engineer will confirm the results and accept or reject the work. The work will not be accepted if it holds water more than 1/4 inch deep or for a distance greater than 5 feet. Unacceptable work must be removed and replaced.

B. Testing Frequency and Related Inspections

1. Testing frequency shall be in accordance with **Table 11-1**.

2. At least 4 compressive strength cylinders shall be taken from the same concrete delivery truck to provide design compliance testing at the laboratory. Two of the four specimens will be tested at 28 days for acceptance and 1 shall be tested at 7 days for information. The fourth

cylinder shall only be necessary if the 28-day fails. Additional cylinders may be required, as directed by the City Engineer.

C. Placement (Inspection)

1. Concrete placement shall be done in a manner such that the concrete is not segregated or altered before placing. It shall not be allowed to free fall more than 5 feet. Concrete shall be placed in lifts not to exceed 18 inches.
2. A sufficient number of vibrators shall be used to properly consolidate the concrete as required.
3. Construction joints and expansion joints shall be constructed in conformance with approved plans and specifications.

11.5 MISCELLANEOUS

11.5.1 Traffic Signs, Striping, and Signals

A. Installation/Application

The City Engineer shall verify that traffic control devices are installed or applied at appropriate locations as shown on the approved signing and striping plans.

All striping layouts will be reviewed by the City Engineer prior to any installation of paint or markings. The City requires a 48-hour notice before any application for inspection or approval.

CHAPTER 12 – ACCEPTANCE/WARRANTY PROCEDURES AND RECORD DRAWINGS

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CHAPTER 12 – ACCEPTANCE/WARRANTY PROCEDURES AND RECORD DRAWINGS

12.1 GENERAL

This chapter defines the requirements for approval and acceptance of the Public Improvements installed within the rights-of-way and easements. This chapter also covers warranty and record plan (as-builts) requirements.

12.1.1 Developer's Process

The Developer shall be required to meet the following process prior to the acceptance of the public improvements and maintenance:

A. Completion of Work

Completion of all Public Improvements required in the approved Construction Plans & Specifications in accordance with these Standards.

B. Notification

Developer notifies the Public Works Inspector and the Engineer of Record of the Project Completion.

C. Inspection – By Engineer of Record

The Engineer of Record shall perform a site inspection to determine if the project is substantially complete and ready for a joint inspection as described below. The Engineer of Record shall generate a deficiency list (punch list) and all items on the list shall be corrected before scheduling a joint inspection. The City Engineer may deem some punch list items as incidental and allow the scheduling of the joint inspection.

C. Joint Inspection

A joint inspection will be performed with City representatives, the Engineer of Record, and the contractor. The public improvements will be inspected for compliance to the plans, standards and specifications. The Engineer of Record shall develop a final punchlist.

D. Correction of Deficiencies

The Contractor or Developer shall correct deficiencies. As-built survey may identify additional deficiencies, which shall be addressed as stated below.

E. Submittal of Record Plans

The Engineer of Record shall submit signed and sealed Record Plans (As-builts) in accordance with the description in **Section 12.5**. One hard copy, one electronic copy in PDF format and one electronic copy in .dwg format shall be submitted to the City Engineer's office. A review copy in PDF format will be required for review purposes prior to the final submittal.

F. Initial Acceptance

After the Contractor has corrected the deficiencies identified on the punch list and the Engineer of Record has inspected the site, the City may be contacted by the Engineer of Record to inspect the corrections. Upon satisfactory completion of the punch list items and submittal of the public improvement construction costs, warranty guarantee, inspection reports, material testing reports, engineer certifications, final as-built drainage report, as-built plans, and any other project requirements per the approval letter, initial acceptance shall be granted.

G. Start of Warranty Period

Upon written initial acceptance by the City, the warranty period shall commence.

H. Warranty Inspection

No more than forty-five days prior to the completion of the warranty period, the City Engineer may inspect all public improvements for defects in workmanship or materials. A deficiency list shall be developed and provided to the Developer. Normal wear and tear shall not be considered a deficiency.

I. Written Notification of Release

Once the Developer/Contractor has satisfactorily completed any necessary repairs or replacements at the end of the warranty period, a written notification from the City shall release the Developer of all future repairs for the Public Improvements and the Warranty Guarantee shall be released to the original provider.

12.2 INITIAL ACCEPTANCE

12.2.1 Recommendation for Initial Acceptance

After the Contractor has completed the punchlist, the Engineer of Record shall inspect and notify the Public Works Inspector that the work has been complete. The Public Works Inspector shall recommend granting or denial of initial

acceptance based on re-inspection for compliance with the joint inspection punch list.

If new deficiencies are found, either in quality or extent of construction, the Developer/Contractor shall be notified in writing of these deficiencies. These deficiencies shall be also be corrected, and additional inspections shall be performed until the work is acceptable.

12.2.2 Initial Acceptance Letter

The City Engineer shall issue written notice either granting or withholding Initial Acceptance within ten working days of the acceptance re-inspection. The Initial Acceptance letter shall specify the date on which the Developer is eligible to request Final Acceptance.

12.2.3 Submittal of Record Plans

Prior to issuance of the Initial Acceptance, Record Plans shall be completed, stamped, and signed by the Engineer of Record and submitted to the City Engineer. The Record Plans shall be submitted in paper and electronic form (as specified by the City Engineer). Refer to **Section 12.5** for Record Drawing requirements.

12.2.4 Submittal of Warranty Guarantee

Prior to issuance of the Initial Acceptance, a Warranty Guarantee in the amount of 25% of all Public Improvements associated with the project shall be submitted to the City. The following items shall be included on the Guarantee:

- Identify guarantee as for MAINTENANCE.
- Name of project.
- Project description & location (address, subdivision, if applicable).
- Description of items guaranteed & total construction cost of public infrastructure.
- Name the City of Fayetteville as Obligee or Duel Obligee.
- Contact information for the provider of guarantee – (who purchased the guarantee).

12.3 WARRANTY PERIOD

12.3.1 Definition of the Warranty Period

The Warranty Period for all Public Improvements shall be two years. During the Warranty Period, the Developer/Contractor shall guarantee the work to be free of any damage or defects in workmanship and material. The Warranty Period shall start the date that Initial Acceptance occurs. The Warranty Period shall end with the Final Acceptance of the Public Improvements. If deficiencies are noted during the City's warranty inspection, the Developer/Contractor shall repair the deficiencies.

12.3.2 The Warranty Guarantee

A Warranty Guarantee shall be required for the entire Warranty Period. The Warranty Guarantee shall be in the form of a letter of credit, maintenance bond, or cash deposit in accordance with the Unified Development Code Chapter 158. The Guarantee shall be in the amount of 25% of the total value of the public improvements for the project. (Including Water/Sewer/Drainage/ Sidewalk/etc.)

12.3.3 Time Frames for Completing Repair

At any time before the completion of the Warranty Period, the City may notify the Developer of needed repairs. If repair areas are considered to be an imminent danger to the public health, safety, and welfare, the Contractor shall act within 24 hours to complete the repair. If the work is not considered a safety issue, the Developer has 10 working days to schedule the work, and 30 calendar days to complete the work. Extensions of time may be considered when necessary due to weather constraints.

12.3.4 Failure to Complete Repair

If the Developer has not completed the warranty repairs in the time frame specified, the City may choose to affect the necessary repairs. The City will either invoice the Developer for all costs for the related work plus a $500.00 administrative fee or it will collect from the guarantee.

12.3.5 Responsibility for Maintenance

The Developer is responsible for maintaining all public improvements throughout the Warranty Period.

12.4 FINAL ACCEPTANCE

12.4.1 Request for Final Inspection

Within 45 days of the end of the Warranty Period, the Developer shall request a final inspection and acceptance, in writing, to the City Engineer.

12.4.2 Preparation for Inspection

The Developer is responsible for sweeping and cleaning public improvements for inspection. If the Developer does not provide a clean site, including having curb flowlines clear of debris and dirt, then the inspection may be postponed until the site is sufficiently clean.

12.4.3 Inspection and Punchlist

The City Engineer shall inspect all Public Improvements related to the Project. If applicable, a written final punchlist shall be compiled listing any necessary repair or replacement of materials or workmanship. The punchlist shall be sent to the Developer and Contractor.

12.4.4 Damage Caused by City Crews

If the Developer can demonstrate that the City maintenance crews caused damage to certain improvements, the Developer will not be held responsible for the replacement.

12.4.5 Re-Inspection

If repair or replacement of Public Improvements is required, the Developer/Contractor shall complete repair or replacement within thirty calendar days of receipt of the final punchlist, unless otherwise agreed upon. Upon completion, the Developer/Contractor shall contact the City Engineer for a re-inspection.

12.4.6 Release from Responsibility

Once all repairs or replacements are satisfactorily completed, the Developer/Contractor shall receive written notice from the City that all Public Improvements are complete and the City releases the Developer/Contractor from responsibility for all future maintenance and repairs for the Public Improvements on this project.

12.4.7 Release of Warranty Guarantee

Upon the satisfactory completion of the final punchlist the City will release the Warranty guarantee.

12.4.8 Failure to Complete Repair

If the Developer has not completed the warranty repairs in the time frame specified, the City may choose to affect the necessary repairs. The City will either invoice the Developer for all costs for the related work plus a $500.00 administrative fee or it will collect from the guarantee.

12.5 RECORD PLANS (AS-BUILTS)

12.5.1 Updating Plans with Design Changes

The Construction Plans shall be updated with all design changes that occurred after plan approval. The final installation of all public infrastructure shall be surveyed prior to submittal of record drawings. The Professional surveyor shall provide stamped drawings specifically identifying the limits of as-built survey performed. Field changes not previously approved by City Engineer, discovered during the as-built process are at the Contractor's risk and may not be accepted.

A. Street

Street Record Drawings shall identify the actual pavement type and grade or mix type used; if the subgrade was treated or additional undercut: location of any under drains added; and document all changes to widths and lengths for streets, sidewalks, and curbs.

- At 100 ft interval or as necessary to reflect actual placement of roadway, the back of curb shall be located in reference to the existing/or proposed right-of-way.
    - Deviations more than 6 inches shall be identified on the plans and included in a transmittal letter to the City Engineer.
    - Additional Right of Way or Reconstruction may be required.
- At grade breaks, no more than 500 ft intervals, profile and cross slope verification will be performed and shown on plans.
    - Deviations more than 0.5% profile or cross slope shall be identified on the plans and included in a transmittal letter to the City Engineer.
    - Geometric K values no longer meeting city criteria shall be evaluated.
    - Additional Calculations or Reconstruction may be required.

- Record drawings shall identify all signage and striping locations as actually placed in the project.

B. Drainage

Record storm drainage drawings shall document the location, size, rim elevation and invert elevation of all pipes (including pipe class), inlets, riprap, headwalls, detention pond volumes, swale cross-sections and all other storm drainage infrastructure shown on the construction plans, including those improvements located in areas outside of the public right-of-way, if appropriate. Record drawings shall also show all pipe and/or drainage way/swale grade percentages.

- More than 2 ft deviation of design alignment shall require new easement dedication or adjustment of the storm drain.
- More than 0.1 ft deviation of design elevation shall require revisions in the drainage report. Any field changes, that no longer meets drainage design criteria, shall be removed and replaced.
- Any field changes, that creates an adverse slope, shall be removed and replaced to original design.
- Change in specified material shall require revisions to the drainage report.

C. Utilities

Water and Sanitary Sewer Record drawings shall document the location, size, invert elevations and rim elevation of all pipes and manholes, location of all valves, changes in direction, encasements, meters, services, hydrants, etc.

- Professional surveyor shall provide stamp drawings specifically identifying the limits of as-built survey performed.
- More than 2 ft deviation of design alignment shall require new easement dedication or adjustment of the utility drain.
- See Water & Sewer Specifications for additional criteria.

D. Other

Record drawings shall verify other information as specifically requested by the City Engineer or outlined in the project's conditional approval letter.

12.5.2 Minor Design Changes

Minor changes are not required to be included on the Record Plans. Minor changes include incorrect references and grade changes less than 0.1 foot.

12.5.3 Submittal of Plans

A Licensed Arkansas Professional Engineer shall update and stamp the As-Built Construction Plans. The Engineer shall submit the plans to the City and receive approval prior to the Initial Acceptance.

The Engineer must also certify that the streets, sidewalk, storm sewer, water, fire line, and sewer lines, etc., were installed per approved plans and City of Fayetteville requirements.

12.5.4 Form of Submittal

All Record Documents shall be submitted in the following formats as required by the City Engineer:

- Plans shall be submitted in electronic format as specified by the City Engineer, in PDF format, in .dwg format and one full size paper copy.
- Warranty Guarantee shall be original documents.
- All other documents shall be submitted in electronic PDF format.
    - Public improvement construction costs
    - Inspection reports
    - Submittals & material testing reports
    - Engineer certifications
    - Final as-built drainage report